MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 38 JULY, 1932 Number 11

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 880

Modern Automobile Transmissions Require New Standards of Accuracy—*By Charles O. Herb* 801
Present Practice in Nitriding Steel—*By H. A. Pearson* 809
Arc-welded Jigs, Fixtures, and Gages—*By L. E. Fuller* 811
Charts for Rate Setting and Cost Estimating—*By H. H. Herzog* 815
Speeds and Feeds for Carbon and High-speed Steel Drills—*By A. J. Snyder* 816
Editorial Comment 818
A Courageous Texas Farmer Sets a Good Example—There Has Been No Depression in the Realm of Ideas—A Leading Industry Decides to Accept a New Responsibility—Volume-Mindedness is a Long Word Well Worth Thinking About
Precision Boring with Diamond and Cemented-carbide Tools 823
Tool and Die Makers Take Contracts from Their Own Firm—*By B. C. Booth* . 826
Economical Milling Procedure Developed by Engineering Study 827
The Designer Has a Wide Choice of Materials—*By James Vincent* 831
Apparatus for Hardening Delicate Work—*By Hubert R. Schmidt* 842
Advantages Obtained by Seating Assemblers at Right Angles to Conveyor 844
Rolling Down Burrs in a Power Press—*By J. E. Fenno* 849
Getting Best Results from Belted Motor Drives—*By Robert W. Drake* 851

DEPARTMENTS

Notes and Comment on Engineering Topics 817
Ingenious Mechanical Movements 819
The Shop Executive and His Problems 822
Special Tools and Devices for Railway Shops 833
Design of Tools and Fixtures 835
Ideas for the Shop and Drafting-room 846
Questions and Answers 848
New Shop Equipment 857

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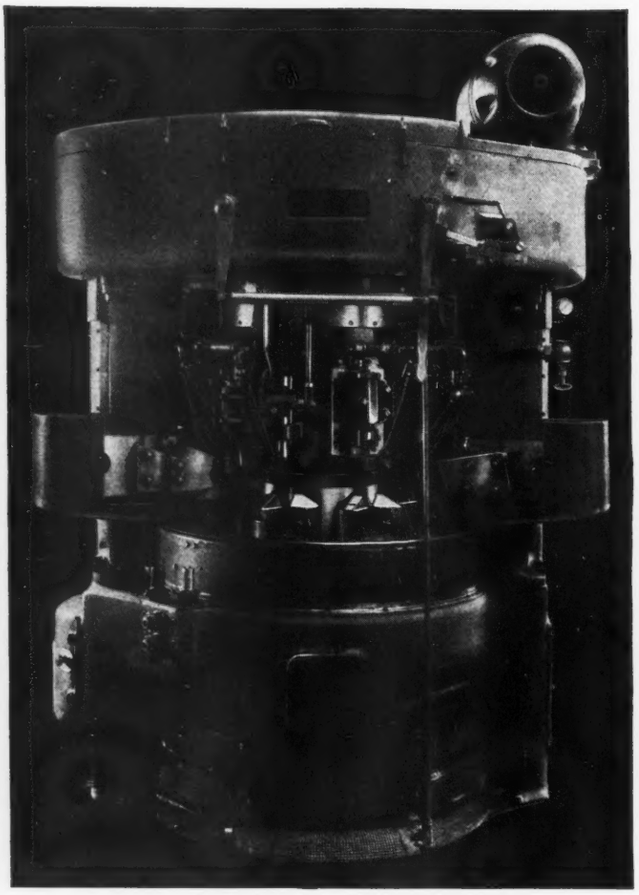

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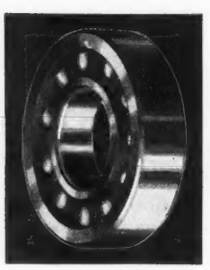

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NEW DEPARTURE BALL BEARINGS

MACHINERY

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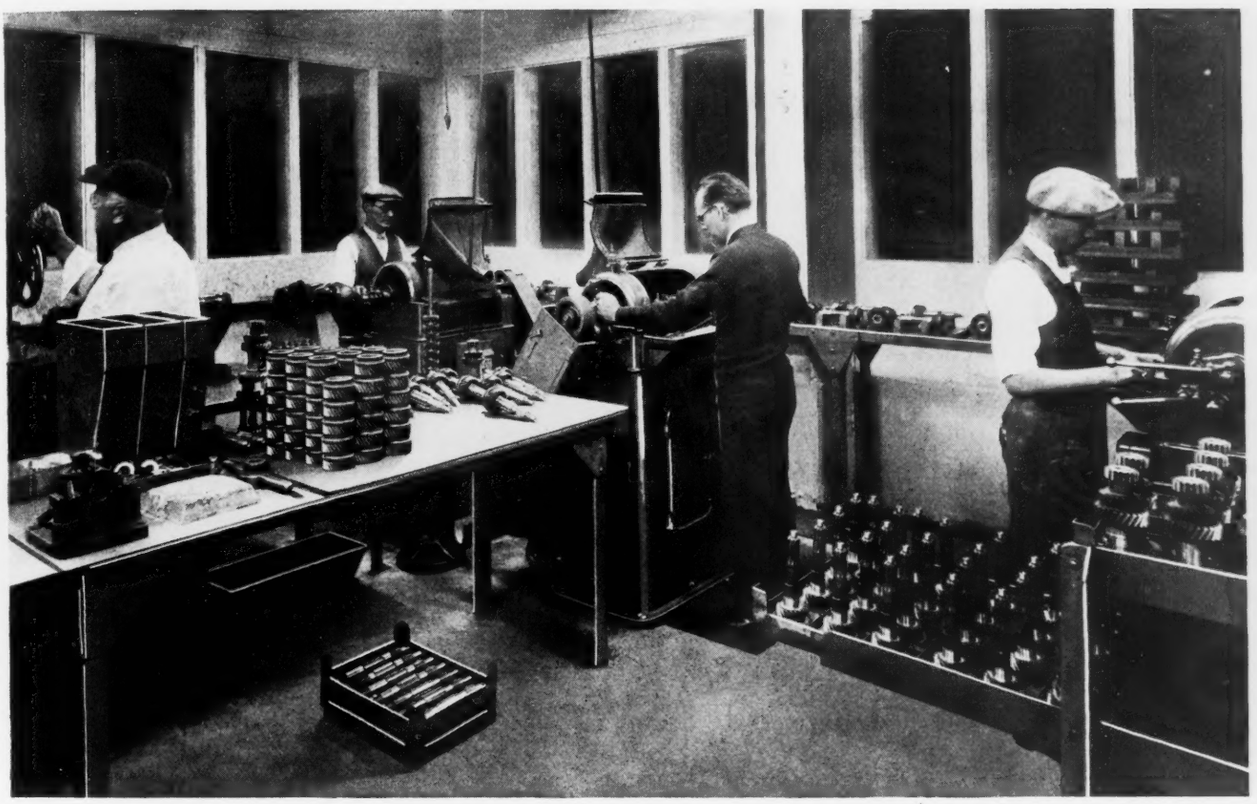


Modern Automobile Transmissions Require New Standards of Accuracy

Making Tens of Thousands of Gears with Tool-room Precision —the Practice of the Hudson Motor Car Co.

By CHARLES O. HERB

THE adoption of synchro-mesh and silent-second transmissions by automobile manufacturers has brought about important changes in producing the gears. Different methods of manufacture and inspection had to be developed for the constantly meshed helical gears that have replaced the driving and intermediate-speed spur gears previously used. In addition, it was necessary to provide equipment for making the synchro-mesh gears and clutches by means of which the drive can be transmitted either direct or through constantly meshed helical gears.

The methods of manufacture and inspection employed by the Hudson Motor Car Co., Detroit, Mich., assure transmission gears of tool-room accuracy. To insure quiet operation and true tooth bearing, the helical gears and two of the spur gears are carefully matched before they are assembled into transmission units. This matching is done in the sound-proof room shown in the heading illustration. The more important operations performed in making transmission gears in the plant mentioned will be described in the following.

All Gear Blanks are Set up from Ground Surfaces for Cutting the Teeth

Fig. 1 shows the various gears, shafts, and clutches included in the transmission unit. Only

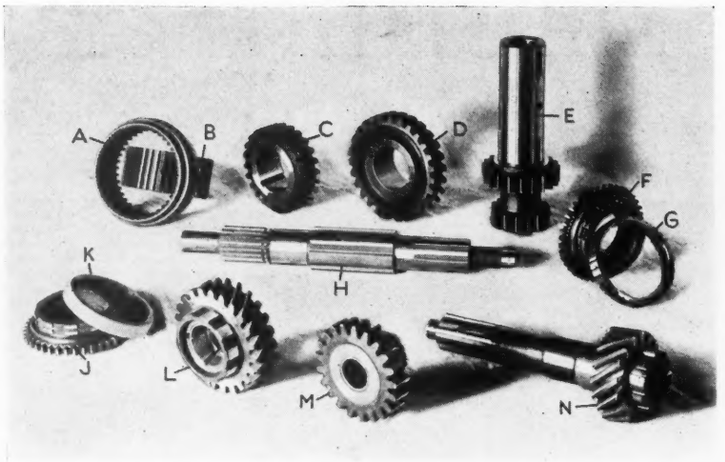


Fig. 1. Gears that Make up the New Hudson Synchro-Mesh Silent-second Transmission

the low-and-reverse sliding gear and the reverse idler gear shaft are missing. All these gears and shafts are made from nickel steel of SAE 2345 specification. They come to the transmission department as rough forgings and are turned and faced in standard types of machines. Bores, generally speaking, are drilled and broached by conventional means.

One of the most important preliminary operations consists of accurately grinding, at right angles to the gear axis, both the hubs or faces of all the gear blanks that are separate from shafts. This operation insures accurate setting up of the blanks in the tooth-cutting machines. For the same purpose, shafts that have integral gears are ground cylindrically before the gear teeth are cut.

Use is made of machines equipped as shown in Fig. 3 for grinding the blanks from which gears *C*, *D*, *L*, and *M*, Figs. 1 and 2, are made. These machines are cylindrical grinders provided with a duplex fixture arranged for rotating two gear blanks on arbors located at right angles to the grinding wheel axis. Accurate setting of the blanks on the arbors is insured by the broached blank holes. The blank hubs and faces are ground by traversing the grinding wheel horizontally past the blanks. The arbors are rotated independently through a clutch; consequently, one arbor can be reloaded while work on the other arbor is being ground. An air cylinder operates the wheel-slide quickly back and forth between the two work-arbors.

Helical gears *C*, *D*, *L*, and *N*, Fig. 1, are hobbed either in Cleveland eight-spindle hobbing machines, as illustrated in Fig. 4, or in Barber-Colman and

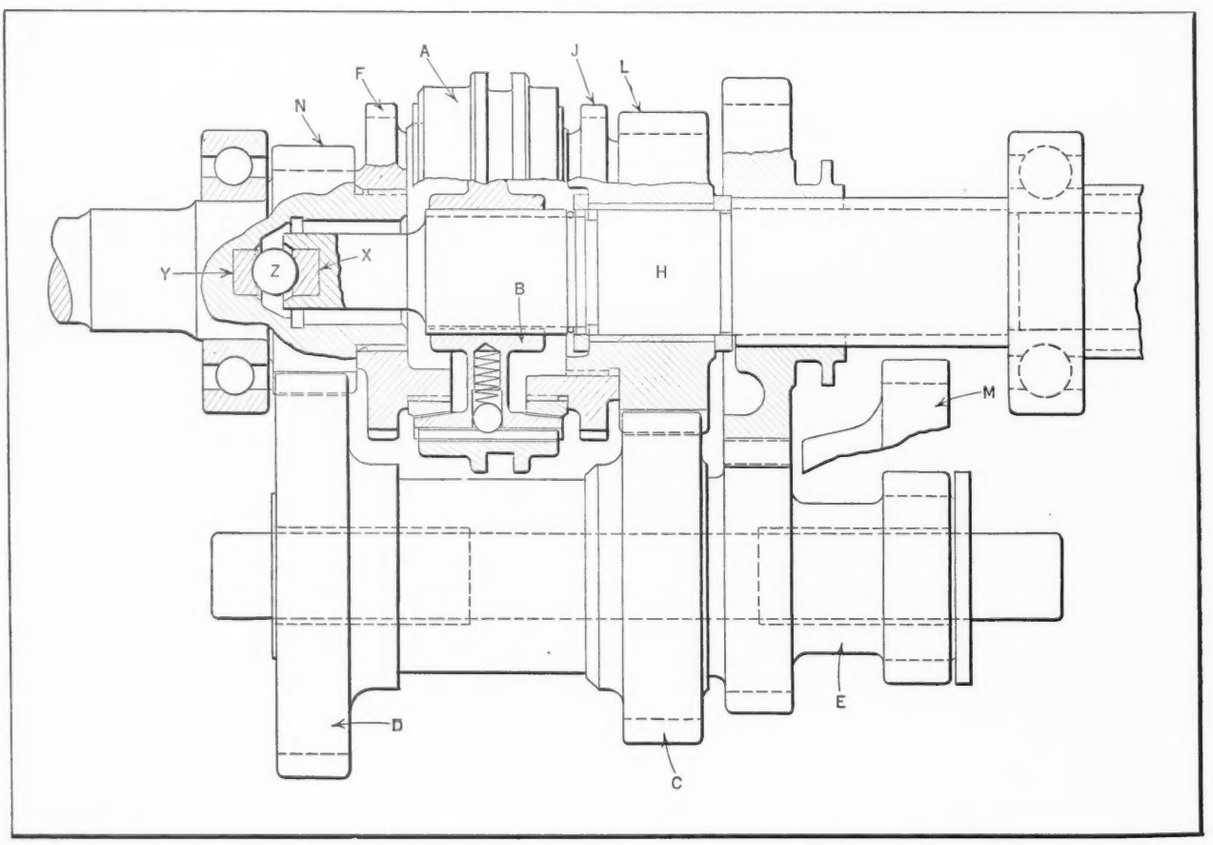


Fig. 2. Diagrammatic Illustration of the Main Drive Shaft and Countershaft Units of the Hudson Transmission

Gould & Eberhardt machines. One of the latter type is shown in Fig. 7. The blanks are assembled on arbors face to face or with spacing washers between. The main drive gear *N*, Fig. 1, is also hobbed in Gould & Eberhardt machines, while the synchro-mesh gears *F* and *J* and clutch-driven gear *B* are handled in Cleveland hobbing machines. The teeth of all helical gears are finished in one cut by ground hobs.

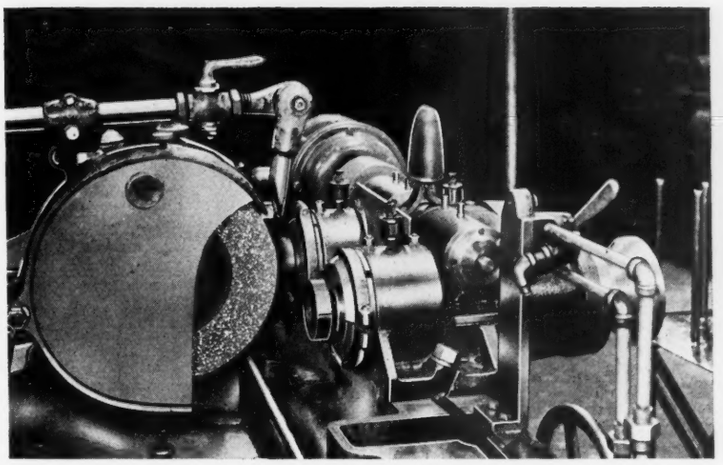


Fig. 3. All Gears Separate from Shafts are Ground on Faces before the Teeth are Cut

The teeth of the larger spur gear on countershaft *E*, Fig. 1, are rough-hobbed in a Gould & Eberhardt machine, and are then finished in a Fellows high-speed gear shaper. The teeth of the smaller gear are cut in two operations on Fellows gear shapers, and the teeth of the low-and-reverse sliding gear and of the reverse idler gear are cut in machines of the same type.

The splines on the left-hand end of the main drive spline shaft shown at *H*, which engage internal teeth broached in the clutch-driven gear *B*, are true involute gear teeth of 15 diametral pitch. They are cut on a Fellows gear shaper, as illustrated in Fig. 8, and give a very satisfactory fit between the shaft and the gear.

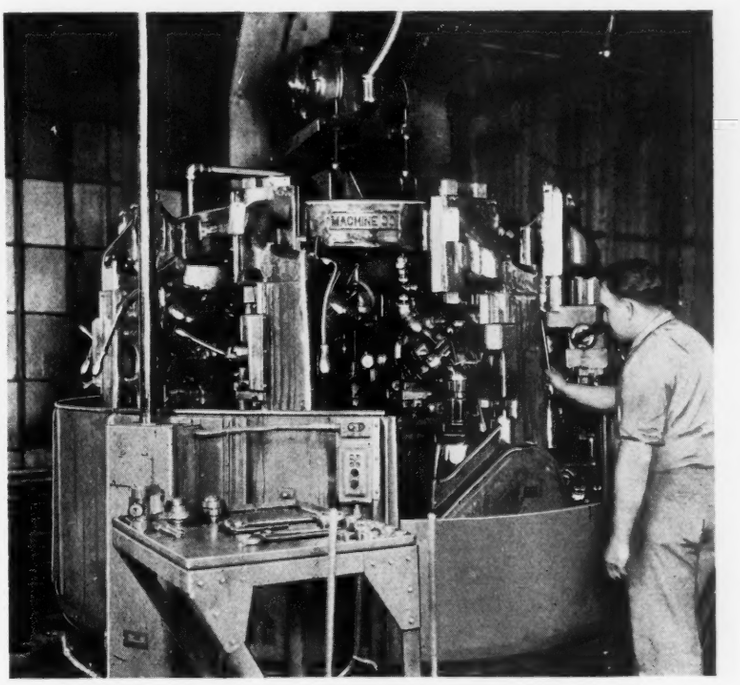
A feature of this spline-cutting operation is the manner of supporting the work at the upper end. This end has been bored out previously to receive a small pellet made of a metal composition having oilless bearing characteristics. When the transmission is in service, this pellet, which is shown at *X*, Fig. 2, helps to absorb the thrust between the main drive and the spline shafts. Block *A*, Fig. 8, carries a center shaped to cut the hole in the shaft. For reloading, the block can be swung out of the way.

The internal teeth of the clutch sleeve *A*, Fig. 1, are broached in the operation illustrated in Fig. 5. Prior to this operation, the blank is faced on one side, the hole is bored, and a groove is form-cut in the middle of the bore, as indicated at *V*. This groove must be located accurately from the finished face and must be smooth. Balls assembled in the holes of the clutch-driven gear *B*, Fig. 1, ride in this groove, as shown in Fig. 2.

In the broaching operation, the clutch sleeve is placed with the finished face against the fixture, so as to insure that the teeth will be produced at right angles to that face. The front section of the broach is designed to true up the hole preliminary to the broaching of the teeth. At the rear end of the broach there is sufficient space to accommodate seven or eight finished clutch sleeves before it is necessary to stop the machine for removing the work.

This broach has a maximum diameter of about 3 13/32 inches and a length of 47 1/2 inches. It weighs approximately 125 pounds. Because of its weight, a foot-operated device has been provided to lift the broach when entering it into the work. This device has eliminated a helper. It consists merely of two rollers, one of which may be seen at *A*. When it is desired to enter a broach into a piece, these rollers are raised by depressing a treadle so as to swivel bracket *B*. The broach can then be quickly

Fig. 4. Some Helical Gears, the Synchro-mesh Gears, and the Clutch-driven Gear are Hobbed on this Eight-spindle Machine



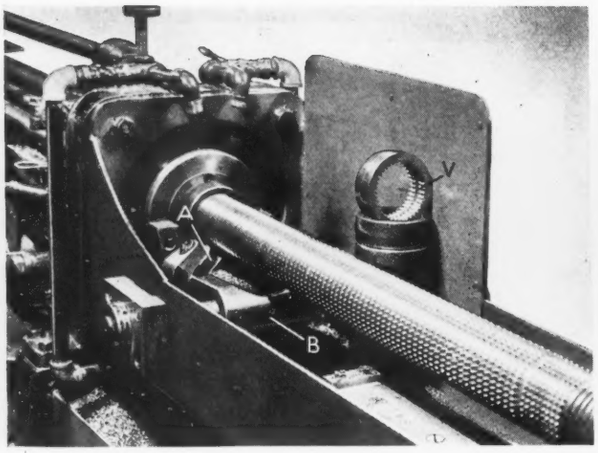


Fig. 5. A Foot-operated Device Facilitates the Handling of this 125-pound Broach Used for Cutting the Internal Teeth of the Clutch Sleeve

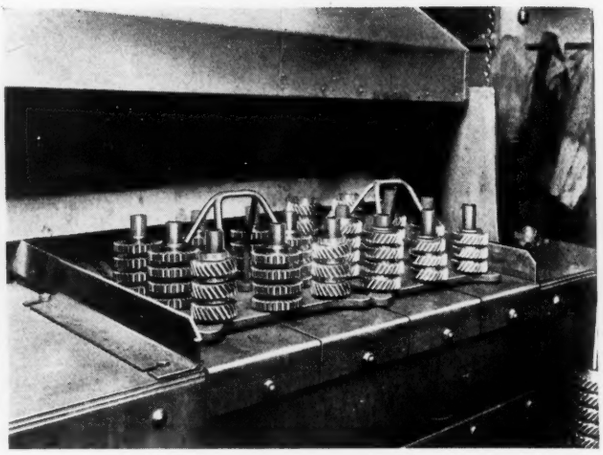


Fig. 6. Continuous Type Electric Furnaces are Used in the Hardening and Tempering Processes for All Gears Separate from Shafts

pushed into place, riding on the rollers. The rollers also serve as a means of supporting the broach when it is disconnected from the ram at the end of each return stroke for loading a new blank.

The involute spline teeth are broached in the clutch-driven gear *B*, Fig. 1, after the hole has been drilled and the blank spot-faced on one side to permit accurate location against the work fixture. This gear is later turned, faced, recessed, and beveled on both sides, after which both faces are ground while the gear is mounted on a splined arbor. The ground faces insure that the gear will be seated properly

Fig. 7. Hobbing Two Constant-mesh Helical Gears at One Time. The Gears are Placed on an Arbor with the Ground Faces in Contact

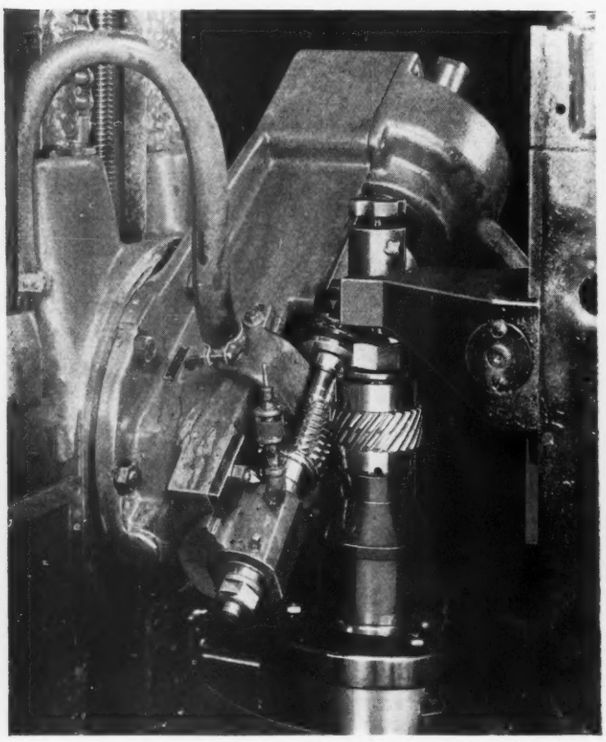
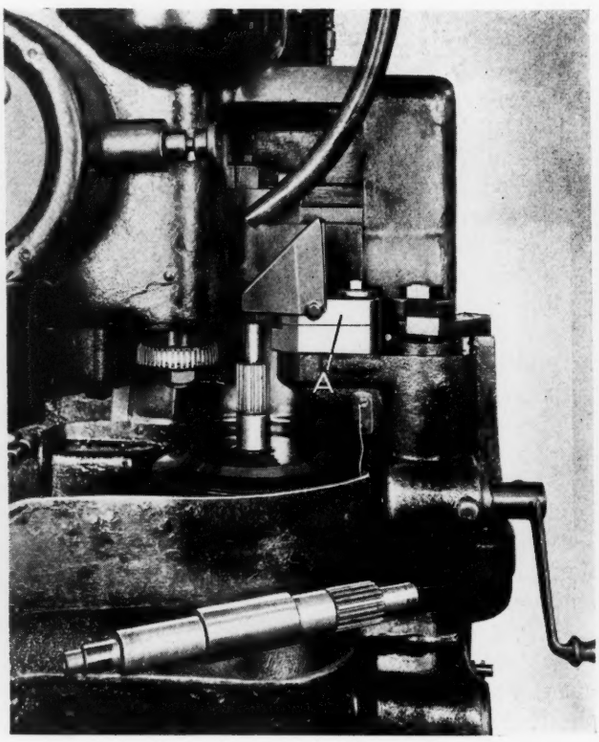


Fig. 8. Teeth of Involute Form are Shaped on One End of the Main Drive Spline Shaft to Engage Internal Teeth of Clutch-driven Gear



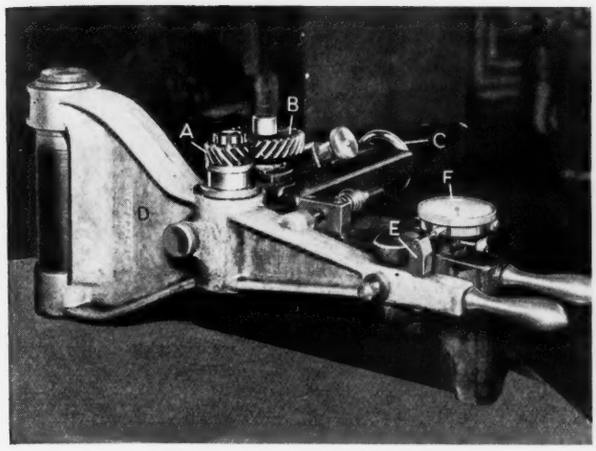


Fig. 9. All Helical Gears are Roll-tested Immediately after being Hobbed and also after They have been Heat-treated and Lapped

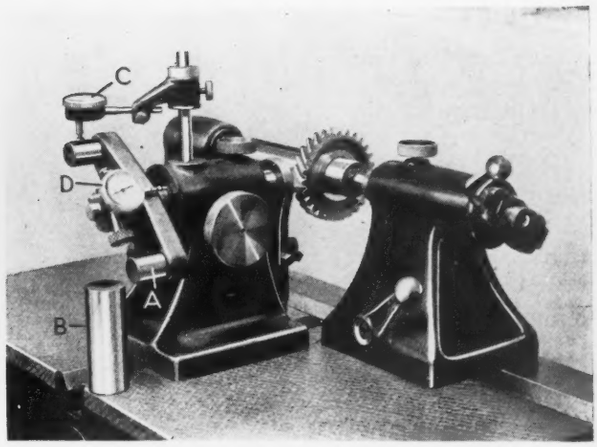


Fig. 10. Equipment Employed for Checking the Spiral Angle of Helical Gear Teeth as well as the Concentricity of the Pitch Circle

when the external teeth are hobbed, as previously mentioned. The eight holes that are later drilled and reamed in the periphery of the clutch-driven gear to receive the balls that engage the groove in the clutch sleeve are also located accurately by the ground faces.

Every gear is checked for concentricity of the pitch circle immediately after it leaves the hobbing machine. By performing the test at this time, errors occurring in cutting the teeth can be rectified before many defective gears have been produced. The test on helical gears is conducted in fixtures

Fig. 11. The Helical Gears are Burnished Both before and after the Heat-treatment by being Rolled in Mesh with Master Gears

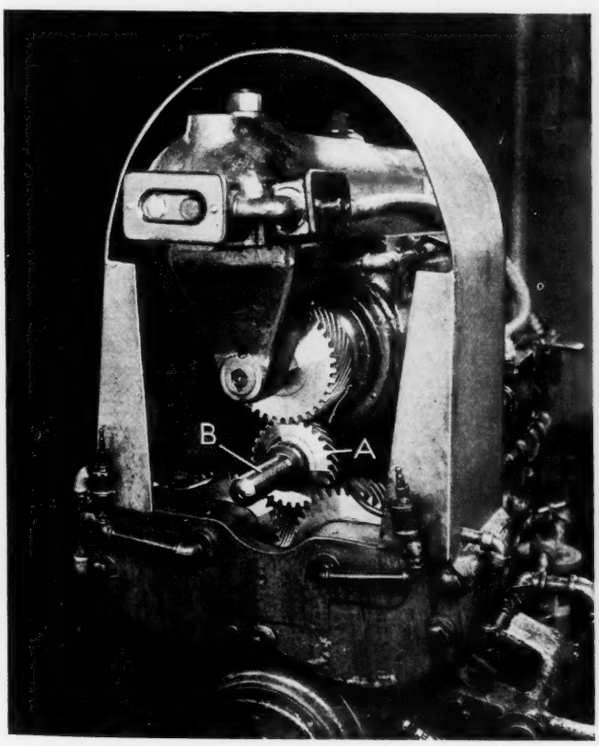
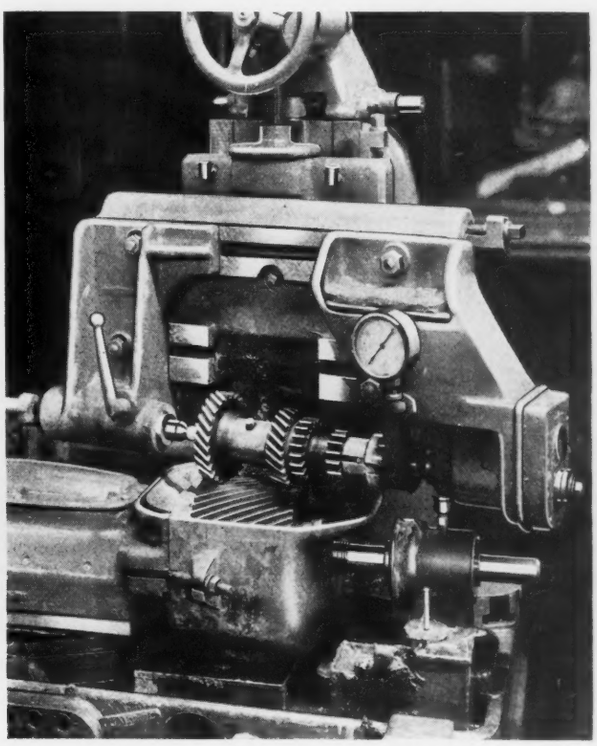


Fig. 12. The Gears are Lapped by Rolling Them in Mesh with a Cast-iron Lap Having Teeth Corresponding with Those of the Gears



of the type shown in Fig. 9, the newly cut gear *A* being rolled in mesh with a hardened master gear *B* by turning handwheel *C*.

Gear *A* is held on an arbor contained in the hinged arm *D*. The arm is swung to the right to bring the gears into mesh, and is then clamped. A hardened plug on block *E* contacts with the spindle of indicator *F*, the dial registering zero when the gears have been properly meshed. As the gears are revolved, the indicator shows any "run out." The total "run out" allowed at this time is 0.002 inch, but the gears seldom show a greater eccentricity than 0.001 inch. The "ten-thousandth" indicator used makes an error of even 0.0005 inch look large.

All helical gears are again subjected to the roll test after they have been hardened, burnished, and lapped. The spiral angles of occasional gears are also checked at this time by means of the fixture illustrated in Fig. 10, to make certain that the hobbing machines are functioning properly. The manner in which this test is conducted will be explained later.

Spur gears are tested immediately after being cut by using a standard Brown & Sharpe machine. As in the case of helical gears, they are roll-tested again after the heat-treating process.

The Gears are Burnished before and after Hardening

All gears, with the exception of the synchro-mesh gears, are burnished before and after hardening. For burnishing, each gear is revolved in mesh with three master gears, a predetermined load being applied to the teeth. The gears are rotated 2 1/2 seconds in one direction and the same length of time in the opposite direction. Both Cincinnati and Bolender burnishing machines are employed, the former type being shown in Fig. 11, where the gear being burnished may be seen at *A*. To keep the machine running, the operator must hold both hands on switches, thus preventing injuries to himself. Handle *B* facilitates loading and unloading of the work.

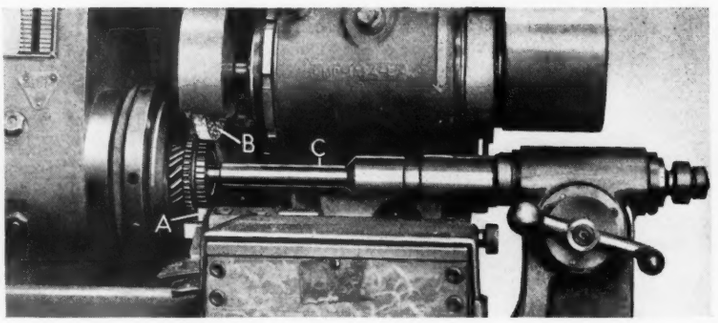


Fig. 13. One of the Synchro-mesh Clutches is Form-turned and Ground in a Single Operation

Each burnishing machine is equipped with an oil filter to insure that the oil fed to the burnishing rolls and the work will be free from grit. Soluble oil is used.

After the gears have passed through the first burnishing operation, they are washed, wire-brushed, and then heat-treated. The various gears that are separate from shafts, with the exception of the synchro-mesh gears, are stacked on fixtures, as shown in Fig. 6, for passing through an electric furnace of the continuous type. They are heated to 1400 degrees F. and are then automatically quenched in oil, which is maintained at a temperature of between 90 and 100 degrees F. They are then carried through a washing machine. Scale is next removed by wire-brushing, after which the gears are tempered by being held at a temperature of 400 degrees F. for two hours in a drawing furnace of the continuous type.

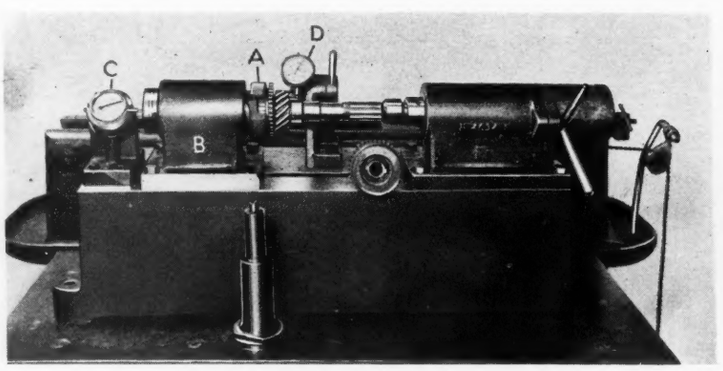
The Synchro-Mesh Gears are Hardened in a Cyanide Bath

Stem gears are hardened in Leeds & Northrup "Hump" furnaces. The synchro-mesh gears are cyanide-hardened in order to obtain an unusually hard outer case and a fairly soft inner core. These gears are first heated to the desired temperature in a "Hump" furnace, then placed in cyanide for 1 1/2 minutes, and finally quenched in oil.

All gears are tested for hardness after heat-treatment. It is the practice to grind a small spot on each gear and check the hardness in a Rockwell tester. The reading for the cyanide-hardened gears must be between 53 and 57 on the C scale, and for the other gears, from 50 to 55.

The hardness test is followed by va-

Fig. 14. Equipment Employed for Determining Accuracy of Synchro-mesh Clutch Surface with Respect to Pellet within the Drive Shaft



rious operations, such as the second burnishing, lapping, grinding of bores and faces, and assembling of the different gears on their shafts. For grinding gear faces, use is again made of machines like that shown in Fig. 3.

Some of these operations call for unusual accuracy. For instance, the bore of the steel-backed babbitt bushings in the main shaft intermediate gear *L*, Fig. 1, must be machined to a specified diameter within a tolerance of 0.00025 inch. The cut is taken with a tungsten-carbide tool.

Lapping is an Important Operation

The teeth of all helical gears are given a high finish by lapping in machines of the type shown in Fig. 12. The machines used were built by the National Broach & Machine Co. The operation consists of rotating the gear to be lapped in engagement with a large cast-iron lap having corresponding teeth. The lap is driven by power and is reciprocated as well as rotated. A hydraulic brake retards the rotation of the work so that the lap will make contact with only one side of the gear teeth when revolved in either direction. It is the practice to drive the lap first in one direction for 2 minutes to lap the drive side of the teeth and then in the opposite direction for 1 minute to lap the coast side of the teeth. Compound is applied to the work by means of a brush. The compound used for this operation is the National Broach & Machine Co.'s L C B water soluble compound.

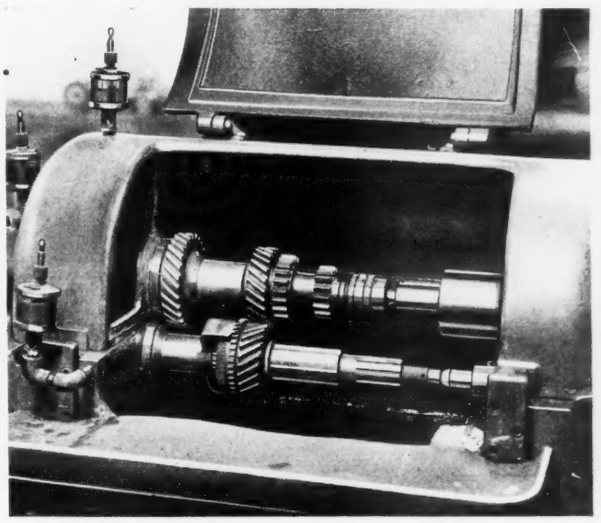


Fig. 15. All the Helical Gears and Two of the Spur Gears are Matched to Insure Quiet Operation by Running Them in Engagement

Final Checking of the Gear Teeth

When the helical gears have been taken from the lapping operation and cleaned, they are checked periodically with the equipment shown in Fig. 10. In order for helical gears to run quietly, the spiral angle of the teeth must be accurate. Therefore, the spiral angle of each tooth is checked by setting up the equipment as illustrated, the front end of the fixture spindle being fitted with a master rack tooth that is entered between the gear teeth. This inspection, as already mentioned, is also performed on occasional gears immediately after they leave the hobbing machines.

At the beginning of the inspection, the proper angular position of the rack tooth is obtained by locating plug *A* accurately in contact with the top of the master end-rod *B*. Indicator *C* is then set to zero. Thus any variation in the spiral angle of the teeth is shown by the indicator. The reading of this indicator must not vary more than 0.002 inch, which means that the spiral angle must be true within exceptionally close limits, because the distance between the center line of the rack-tooth spindle and the center line of the plug that contacts with the indicator is 3 inches.

Indicator *D* shows the concentricity of the gear. This indicator is mounted on the rack-tooth spindle and the spindle of the indicator is in contact with a stationary collar. Thus the indicator shows eccentricity of the pitch circle when the in and out positions of the rack tooth vary as it is entered between the successive gear teeth. The total eccentricity must not be more than 0.002 inch, the average being 0.00125 inch.

After the synchromesh gear *F*, Fig. 1, and its bronze clutch ring *G* have been assembled on the main drive shaft, the clutch surface must be machined to the specified diameter and taper at a given distance from pellet *Y*, Fig. 2. This operation is performed in the machine shown in Fig. 13. It consists of first turning the surface to the desired taper by means of a tungsten-carbide tool at *A*, and then grinding the surface by the use of a grinding wheel *B*.

The vital point in this operation is to locate the tool and grinding wheel accurately with respect to the pellet. This is accomplished by entering the long bar *C* into the work until the end touches the pellet. Bar *C* is mounted on a unit that is automatically connected to the head that carries the turning tool and grinding wheel as the bar touches the work. The tool is of the form type. It cuts a recess in back of the clutch surface, and also machines this surface to the proper angle. It moves in and out only. The wheel is dressed to an angle of 5 degrees.

Fig. 14 shows the equipment used for checking the accuracy of this operation. The ground clutch surface is entered snugly into a tapered socket *A* and then the tailstock center is advanced to support the opposite end of the main drive shaft. Indicator *C* registers against the opposite end of this spindle and thereby gives an indication of variations in the distance between the pellet and the

tapered clutch surface. The reading of this indicator must not show variations greater than 0.003 inch. Eccentricity of the bearing in back of the main drive gear is shown by indicator *D*. This must not be greater than 0.0015 inch.

After the gear units that comprise the transmission have been assembled on their shafts, they are sent to the sound-proof room shown in the heading illustration. This room is constructed, on the outside and inside, of boards 7/8 inch thick, there being about 6 inches of air space between. The single door into the room is wedge-shaped on both sides and at the top so as to exclude noise from the outside. The work parts enter through a small opening and are discharged through a similar one.

All the helical gears are matched to insure quiet operation and good bearing qualities. The matching is done by running the gears in mesh in machines of the type shown in Fig. 15. The first step consists of matching the main drive gear *N*, Figs. 1 and 2, with the countershaft drive gear *D*. In this operation, the main drive shaft is placed between the upper centers of the machine and is power-driven, while the countershaft is held on the lower spindle. A brake can be applied to the countershaft unit.

Various countershaft units are tried out with the main drive shaft until a pair of gears of the necessary quietness has been obtained. Both units are then placed on wooden trays, such as are seen in the background of the heading illustration, and are passed on to a second machine of the same type.

Here the intermediate speed gear *L* of the main drive spline shaft, Figs. 1 and 2, is matched with the intermediate speed gear *C* of the countershaft. This operation is the one illustrated in Fig. 15. Spline shaft units are substituted as often as required until mating gears of the necessary quietness have been obtained. Both these units are then placed on the tray with the main drive shaft previously selected. All three units then go to a third machine.

In the third machine, the reverse idler gear is matched with its mating gear on the countershaft. The main shaft low-and-reverse sliding gear and the synchro-mesh clutch and gear assembly are next fitted to the main drive shaft. They are selected for fit only, a rolling test being unnecessary. The trays of transmission gears now leave the sound-proof room for assembly into a housing. Later the complete transmission is given a running-in test in a second sound-proof room.

Metal-Working Machinery Exports in 1931

The value of American metal-working machinery exported during 1931, according to the Industrial Machinery Division, Bureau of Foreign and Domestic Commerce, slightly exceeded $40,000,000, as compared with $42,000,000 in 1930 and $40,800,000 in 1929. Of the 1931 exports, 86.5 per cent went to European countries. Soviet Russia was the largest customer, absorbing $22,500,000 worth of metal-working machinery, or more than one-half the total exports. The United Kingdom took second place with slightly over $7,000,000, Canada, Germany, and France following in the order mentioned. The Canadian market dropped from $5,410,000 in 1930 to $3,390,000 in 1931. In fact, there was a drop in the exports to practically every country in the world, except Soviet Russia and the United Kingdom.

Considering different classes of machinery exported, we find that grinding machinery accounted for $4,700,000; lathes, $4,000,000; forging machinery, $4,000,000; drilling machines, $2,600,000; milling machines, $2,300,000; and sheet and plate metal-working machinery, $5,550,000. The accompanying table gives the value of exports to different countries in round numbers. The six leading countries absorbed over 93 per cent of the exports.

American Exports of Metal-Working Machinery in 1931

Country	Value	Country	Value	Country	Value
Soviet Russia	$22,502,000	Spain	$116,000	Portuguese Africa	$28,000
United Kingdom	7,040,000	Czechoslovakia	115,000	Venezuela	27,000
Canada	3,390,000	Cuba	90,000	Norway	27,000
Germany	2,216,000	Belgium	71,000	Peru	27,000
France	1,530,000	Brazil	69,000	Irish Free State	24,000
Italy	479,000	Poland	57,000	Finland	21,000
Japan	393,000	Australia	54,000	New Zealand	16,000
British India	246,000	Switzerland	53,000	Uruguay	12,000
Sweden	223,000	Panama	53,000	Dutch West Indies	11,000
Mexico	220,000	Philippines	51,000	British Malaya	11,000
Chile	127,000	Colombia	48,000	Bolivia	4,000
Br. South Africa	127,000	China	42,000	Other Countries	217,000
Netherlands	122,000	Dutch East Indies	28,000	.....	.....
Argentina	121,000	Denmark	28,000	.....	.....

Present Practice in Nitriding Steel

By H. A. PEARSON, Works Manager
Edward Valve & Mfg. Co., East Chicago, Ind.

THE old adage "as hard as steel" has taken on a new meaning in the last three or four years with the introduction of the nitriding process for the surface-hardening of alloy steels. By this process a hardness two or three times that of hardened tool steel is obtainable. Brinell hardnesses of 1000 or more are not uncommon. In order to keep the distinction between nitriding and Nitralloy clearly before us, the following definitions are given:

Nitriding is the surface-hardening of alloy steels at low temperatures by the action of ammonia gas or other gaseous compounds, the decomposition of which results in uncombined nitrogen.

Nitralloy designates a group of steels of special analyses suitable for use in the nitriding process.

Alloy steels containing aluminum, chromium, and molybdenum, with varying amounts of carbon, are suitable for nitriding. In general, the aluminum content is 1.25 per cent; chromium, 1.50 per cent; and molybdenum, 0.20 per cent. Two principal grades of Nitralloy are manufactured, designated as Grade G, having 0.36 per cent carbon, and Grade H, having 0.23 per cent carbon. The carbon content has little effect on the case of the nitrided steel, but affects chiefly the core or unhardened portion of the nitrided part.

Forging, Machining, and Heat-Treating Nitralloy

Nitralloy decarburizes to a much greater degree than alloy steels of approximately the same analysis, but having no aluminum. The decarburized surface must be entirely removed before nitriding; otherwise it will spall badly upon removal from the nitriding furnace. Some engineers advocate painting the decarburized surfaces with aluminum paint to prevent spalling, but the more satisfactory method is to remove this surface completely by mechanical means before placing the work in the nitriding furnace.

Nitralloy forges at approximately the same temperature as a similar S A E steel, with the exception that the rate of heating should be somewhat slower. A good rule to follow when forging is to allow at least 1/8 inch finish on the side to insure complete removal of the decarburized surface formed in the forging furnace and subsequent heat-treating operations.

In the annealed condition, Nitralloy has a tendency to tear rather than shear while being machined. It can be machined in approximately the same way as S A E 1020 steel. Proper heat-treatment greatly improves the machining properties, and heat-treated Grade H Nitralloy having an average Brinell hardness of 250 can be machined on multi-spindle automatics with little difficulty.

Forging and rolling stresses must be relieved in order to minimize distortion of the finished part during the nitriding process. The physical properties of the core can be varied to suit specific requirements by the usual method of quenching and drawing. It has been the author's practice to sand-pack the bar stock in large pipes for the quenching heat (approximately 1850 degrees F.). This lessens decarburization at this high heat. Quenching and drawing to suit the physical properties gives a good machining stock that can be taken directly from the automatics or screw machines without further treatment before nitriding. All sharp corners must be removed from the finished piece to prevent the hard case from chipping at this point.

Preparing Parts for Nitriding

Mention has been made of the necessity of relieving strains before nitriding. All traces of cutting oils must also be removed by a suitable cleaning compound to eliminate injurious gases in the nitriding box. It is often required to have certain surfaces of the finished product left soft, such as threaded sections. If the design permits, the best method is to nickel-plate those areas that are to remain soft. The plating voltage should be kept as low as possible, so as to prevent sponginess in the plate.

Tinning with a 50-50 solder is also a very effective but a slower method. The tinning should be done with extreme care, as the tin has a tendency to creep when subjected to the nitriding heat. One method that has been used is to brush a good grade of varnish over the section adjacent to where the tin is to be applied. The varnish is dried on a hot plate and a thin coating of the soldering flux and tin is then applied. The varnish prevents the flux and tin from creeping to those surfaces that are to be hardened. An excessive coating of tin will melt and drop off on other pieces during the nitriding. Some concerns use asbestos paper between layers of the work to prevent damage from dripping of the tin. A paste of brushing consistency, made of tin oxide and alcoholic shellac, will give fair results.

Practical Hints on the Nitriding Process

The nitriding or hardening process is carried on at a temperature of approximately 1000 degrees F. in an air-tight container through which ammonia gas is circulated. Gaseous compounds other than ammonia can be used, such as dry hydrocyanic acid or cyanogen gas, but ammonia gas is used in all commercial nitriding. The nitriding temperature can be varied to suit the characteristics of the case.

Any standard box type furnace can be used, provided the temperatures can be closely regulated.

The stationary box for holding the nitriding charge is the one most commonly used because of its low first cost. This box has been made of various metals such as chrome-nickel and chrome-silicon steels, Monel metal, enameled steels, and ordinary boiler plate. The life of boiler plate is very short due to embrittlement.

As previously mentioned, the box must be air-tight. This is usually accomplished by the use of a flange on the upper rim of the box which carries a lead seal over which a projecting edge of the cover may be pulled and bolted into place. It is general practice to place the ammonia inlet pipe in a lower corner and the discharge pipe in the opposite upper corner, with the pyrometer protecting tube in the center. All three connections through the box must be air-tight. Nickel tubing should be used for these three connections, and as the discharge pipe has a tendency to clog, it should be inspected at regular intervals.

A retort furnace in which the furnace chamber is of suitable alloy to withstand the temperature and action of the hot ammonia gases and is also air-tight can be used. In this furnace, the work is charged into the retort and sealed at the top by an oil seal on the cover. The ammonia enters at the bottom and discharges at the top.

In the fan type resistor furnace the charge is placed in an alloy container having a screen bottom. This container is lowered into the heating zone and the entire furnace made air-tight by an oil-sealed lid. The inlet and outlet tubes both enter from the top; the ammonia is circulated by a reversing fan placed in the bottom of the furnace, which alternately draws the ammonia down through the work and pushes out the hydrogen gases.

Ordinary cylinders of anhydrous ammonia are used for nitriding. After the charge is placed in any of the types of furnaces described, the ammonia cylinders are connected to the inlet connection of the furnace and the valve of the ammonia cylinder is opened. Samples of the gas, taken from the discharge pipe, are run through a glass pipette for measuring the dissociation, which should be maintained at from 25 to 35 per cent. After the flow of ammonia and the dissociation are regulated, the nitriding requires little further attention.

The nitriding time is measured by the period of time elapsing from the time the predetermined temperature is reached inside the furnace until the final shutting off of the source of heat. As previously stated, both the time and temperature of nitriding may be varied to suit the characteristics of the required case. In the early stages of development, heats were run over seventy-two hours, but this time is being shortened as more is learned of the process.

After the elapse of the predetermined nitriding time, the furnace is shut off, but the ammonia must be allowed to continue to circulate through the container until the temperature of the work has dropped to from 450 to 500 degrees F. The ammonia is then shut off, and the charge removed and allowed to cool in the air. If the process has been carried on without air leaks, the finished product will have a grayish-white luster. Oxygen, if present, will cause the work to be streaked with bluish purple lines, and this is also an indication of a shallow and irregular case.

Hardness Testing of Nitrided Parts

The hardness of a nitrided case cannot be measured by the Brinell hardness testing machine, as the pressure exerted on the steel indentor ball is likely to crush the case. More accurate testing is done by the Vickers diamond pyramid hardness tester; the Monotron is better suited for production testing, on account of the time saved.

Hardness in excess of 1000 Brinell is common; and because of this extreme hardness, nitrided steels are very resistant to erosion. Wear tests of samples of nitrided steel, when rubbed against samples of other alloys with a predetermined load per square inch, show practically no loss of weight and no tendency to seize or tear. Some of the commercial uses for nitrided parts are gages, drill bushings, wrist-pins, gears, pump shafts, and seats and disks for valves and spindles.

* * *

Spring Meeting of Associated Machine Tool Dealers

The spring meeting of the Associated Machine Tool Dealers, held at Granville Inn, Granville, Ohio, June 6 and 7, brought together a representative group of executives engaged in machine tool selling. The keynote of the convention was covered in a series of studies of "Underlying Conditions," a subject suggested by the president of the Association, William K. Stamets. Papers were read dealing with these conditions in each district; the papers also outlined the probable scale of future operations.

The survey made by the dealers who had prepared these papers indicates that machine tool using manufacturers realize the necessity of modernizing their plants in order to compete successfully in future markets by replacing obsolete and worn-out equipment. According to the survey made, the amount of this replaceable equipment is so great that it could keep our machine shop equipment plants busy for years to come. The meeting was addressed by Robert M. Gaylord of the Ingersoll Milling Machine Co., president of the National Machine Tool Builders' Association, who spoke on the subject "The Machine Tool Industry," making a great many constructive suggestions.

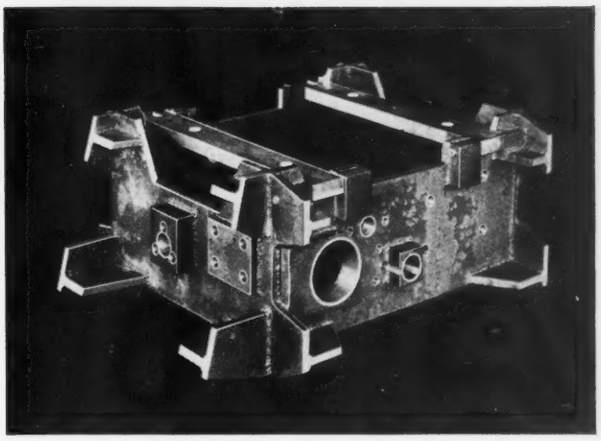
* * *

Welding is making inroads on engineering practice throughout the world. About a year ago, a 27-ton steel freight car was built by welding by the Victorian Government Railways in Australia. This car has withstood a number of severe tests and now additional welded rolling stock is in process of being constructed.

Arc-Welded Jigs, Fixtures, and Gages

An Average Saving of 30 Per Cent in the Cost of Tool Equipment for Interchangeable Parts has been Obtained by Welded Construction

By L. E. FULLER, Tool Engineer
Brown & Sharpe Mfg. Co., Providence, R. I.



NOW is the time for manufacturers in the metal-working industries to consider carefully the best and quickest methods for making their jigs, fixtures, and gages. The rapidly changing conditions of today necessitate constant improvement and frequent change in product design. This trend in our industry has made the problem of jig and fixture construction vastly more complicated.

Tools, jigs, fixtures, and allied equipment for the production of interchangeable parts must be made more quickly and at less cost. Yet accuracy must not be sacrificed for speed, and in many cases must be of an even higher degree than was previously required. That arc welding is a successful answer to this toolmaking problem has been demonstrated by the Brown & Sharpe Mfg. Co. The results obtained by this company during the last three years have assured the adoption of arc-welded construction for its future tool equipment. Other well-known firms have had a similar experience.

It is not enough, however, to apply arc welding to the construction of tool equipment of conventional design. The designs and methods of construction formerly employed in making such equipment of cast iron must be thrown aside. The new jigs, fixtures, gages, and similar tool equipment must be designed with a view to making the best possible use of structural steel in all its various forms. The adaptability of standard plates, angle-irons, and shapes that are readily available and easily welded together must be kept in mind. Standard bushings, clamps, screws, and other available accessories must all be used to the best advantage. The subject requires careful study. Here, as in all engineering, there is no royal road to success.

When welded construction is employed, the plates for jigs can be readily cut to size with an oxy-acetylene torch, which can be employed to cut holes in the jig walls or base as well. The cutting torch can also be used for cutting large holes in bosses to approximately the rough-finished size before finish-

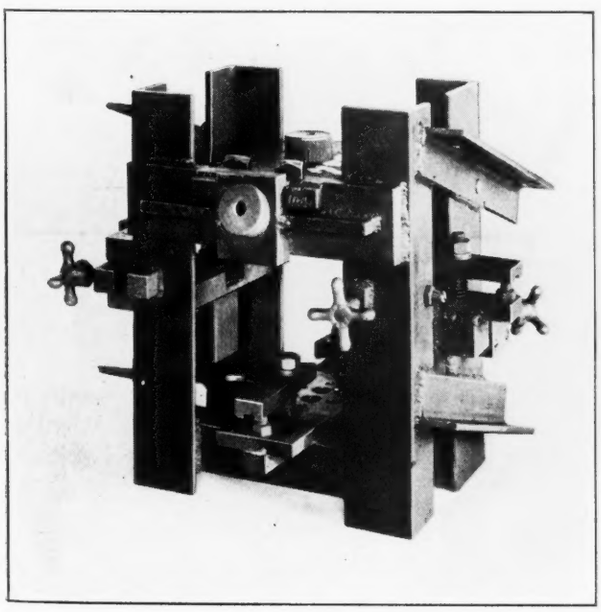


Fig. 1. Drill Jigs of Arc-welded Construction are Now Regularly Used by Many Manufacturers

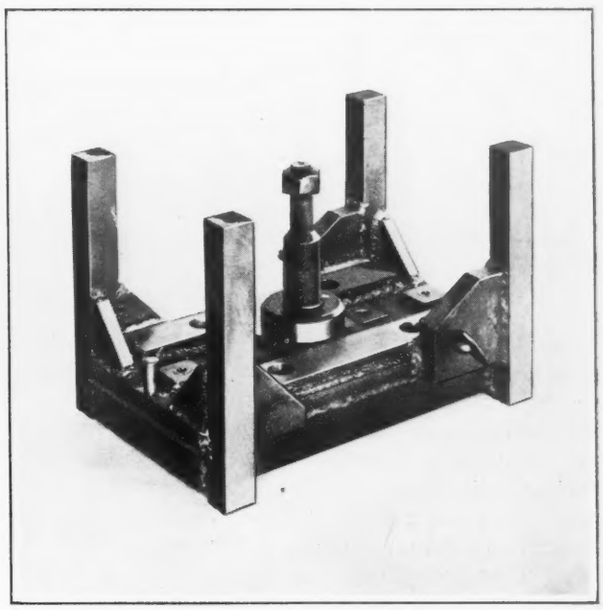


Fig. 2. Properly Designed Arc-welded Jigs are Lighter and Stronger than Cast-iron Jigs

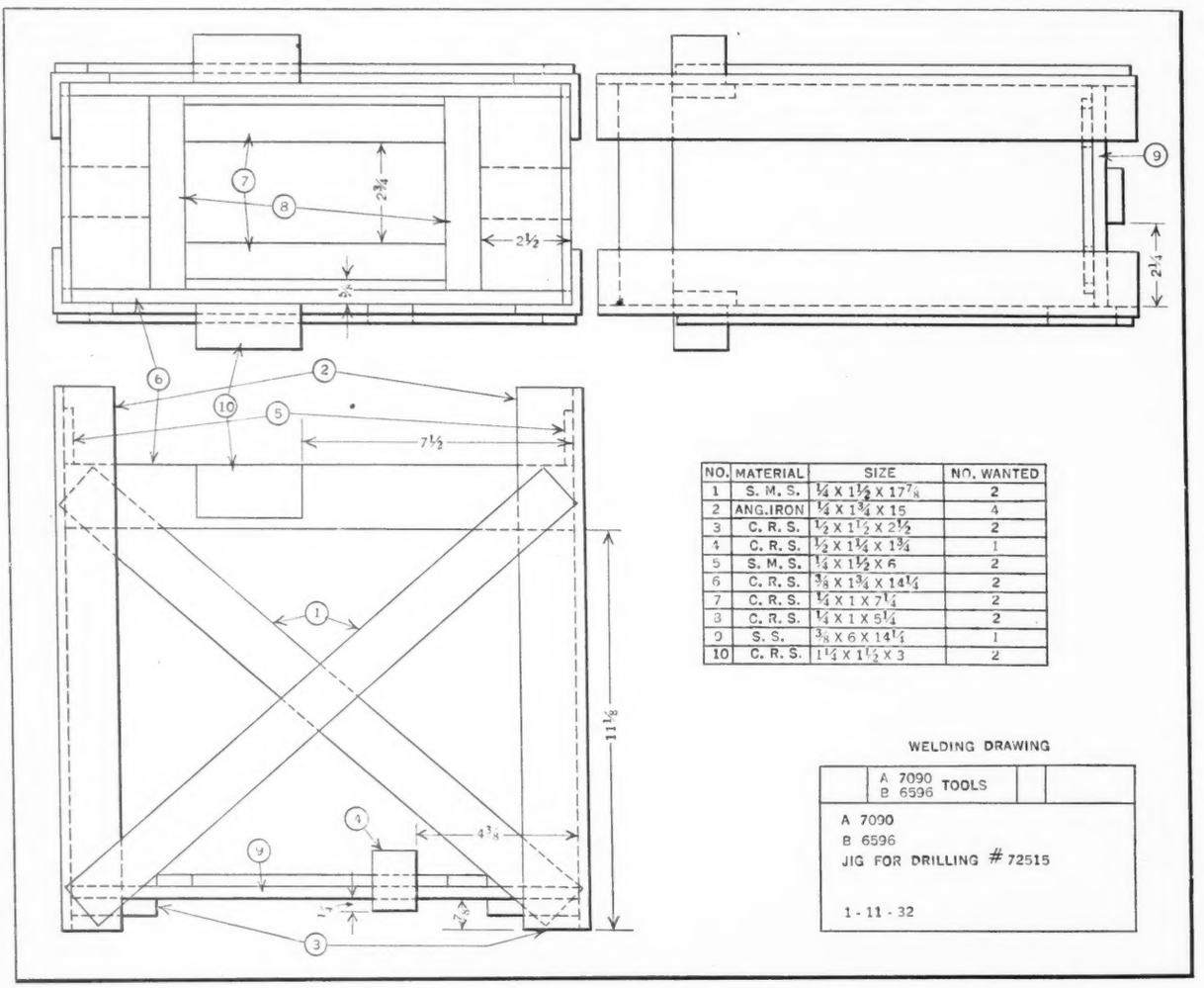
boring. Small bosses can be chucked and drilled before being welded to the jig or fixture frame.

Assembling and Welding the Jig Members

The structural and shaped plates are held together with C-clamps, squared up, and tack-welded by a welder who is experienced in reading blueprints and who can be relied upon to position the members correctly. The tool can then be welded by an experienced welder who is capable of making good arc welds. A good bead weld will usually give sufficient strength. A weld fillet as thick as the wall is not often necessary. The superior strength of steel allows the welded type of jig or fixture to be made lighter in weight than the cast-iron type. If the service requires, the jig feet can be hard-surfaced, but this is not always necessary, as the steel will withstand as much wear as cast iron.

A sketch or simple drawing, such as shown in Fig. 3, can be used to help the welder assemble the jig. This drawing also has on it a list of stock to be cut off and made ready for the welder. The jigs shown in the heading illustration and in Figs. 1 and 2 are typical examples of welded construction. The four corner posts of the box-type jig shown in Fig. 1 are made from angle-irons. This jig shows the facility with which bushings, clamps, and locating blocks can be assembled in almost any position by arc welding. The jig shown in the heading illustration is obviously of a somewhat complicated design, especially from the patternmaker's point of view. Constructing this jig of steel plates assembled by simple arc-welding operations eliminated an expensive pattern and core-box job.

The advantages of the greater strength of steel over cast iron are readily visualized by referring to the design of the welded steel jig shown in Fig. 2. The comparatively slender corner posts of this jig will withstand considerable abuse and would not be broken off should the fixture be accidentally dropped, as would probably be the case with cast iron.



NO.	MATERIAL	SIZE	NO. WANTED
1	S. M. S.	¼ X 1½ X 17⅞	2
2	ANG. IRON	¼ X 1¾ X 15	4
3	C. R. S.	½ X 1½ X 2½	2
4	C. R. S.	½ X 1¼ X 1¾	1
5	S. M. S.	¼ X 1½ X 6	2
6	C. R. S.	⅜ X 1¾ X 14¼	2
7	C. R. S.	¼ X 1 X 7¼	2
8	C. R. S.	¼ X 1 X 5¼	2
9	S. S.	⅜ X 6 X 14¼	1
10	C. R. S.	1¼ X 1½ X 3	2

Fig. 3. Typical Sketch or Drawing Used in Making Arc-welded Jigs

Jigs and Fixtures Can be Changed to Suit Changes in Product

Pieces can be removed from or added to welded jigs to suit changes in the product or manufacturing methods. For example, changes can be made

on the ends of clamps by welding on or cutting off pieces as required, thus eliminating time-consuming milling operations. Milling fixtures for present-day speeds and feeds must have rugged bases and heavy clamps with quick-acting handles. Almost any kind of clamp or handle can be cut to shape with the torch and assembled by welding. The clamps can be hardened in the regular way or the clamping points can be hard-surfaced and ground to shape. Fig. 4 shows plan and elevation views of two well designed fixtures of welded construction.

Gages can also be fabricated by the arc-welding method. The test points of the gages can be placed where needed and provided with suitable supports. Gages made in this manner are very accurate and strong. A typical gage of this construction is shown in Fig. 5.

Normalizing and Finishing Welded Jigs

All arc-welded tools should be normalized by being heated to about 1300 degrees F. and allowed to cool in order to relieve all strains set up by welding together rolled plates, shapes, or whatever types of sections are used.

Good construction should never be sacrificed for appearance. Good-looking tools can be made, nevertheless, by the arc-welding method. Sand blasting and painting improve their appearance, but are not necessary. Naturally, it requires a little more time to machine steel than it does cast iron, but the additional time should not exceed 5 per cent. This may be offset if the designer, in laying out the tool, will provide small blocks for squaring purposes, so that the machine work will be confined to small areas instead of large surfaces. Considerable unnecessary machining can be eliminated by instructing the toolmaker to provide the proper finish for the class of work to be handled, eliminating all unnecessary finish.

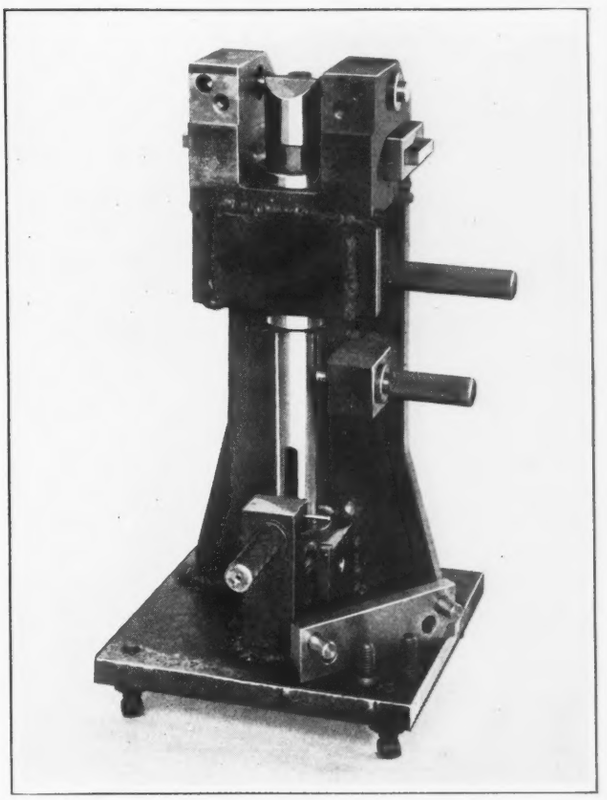


Fig. 5. Arc-welded Steel Gage Frames of this Kind are Strong and Accurate

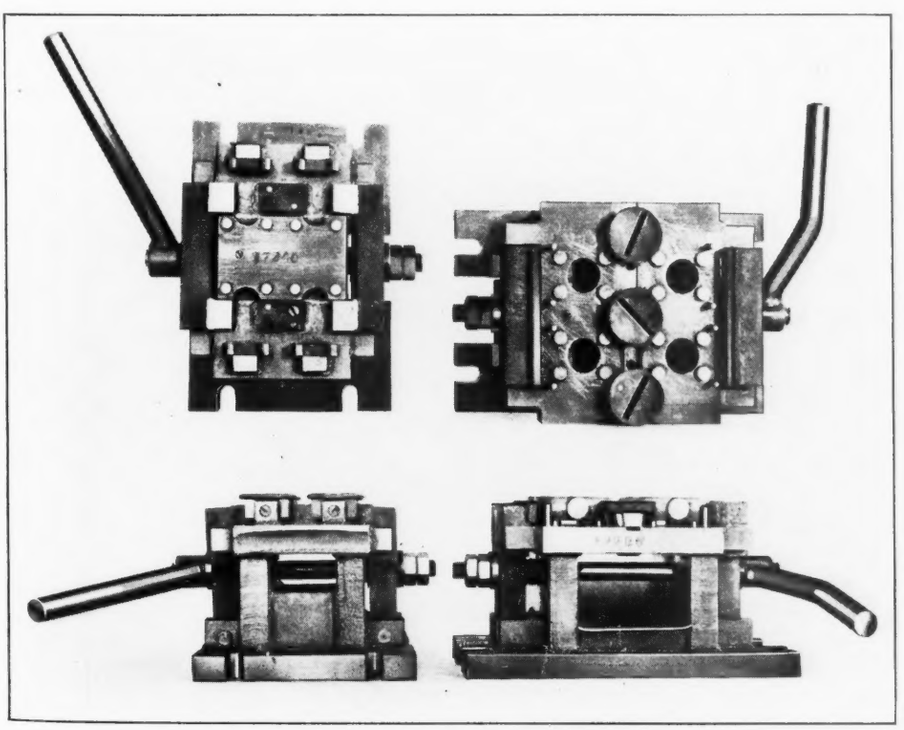
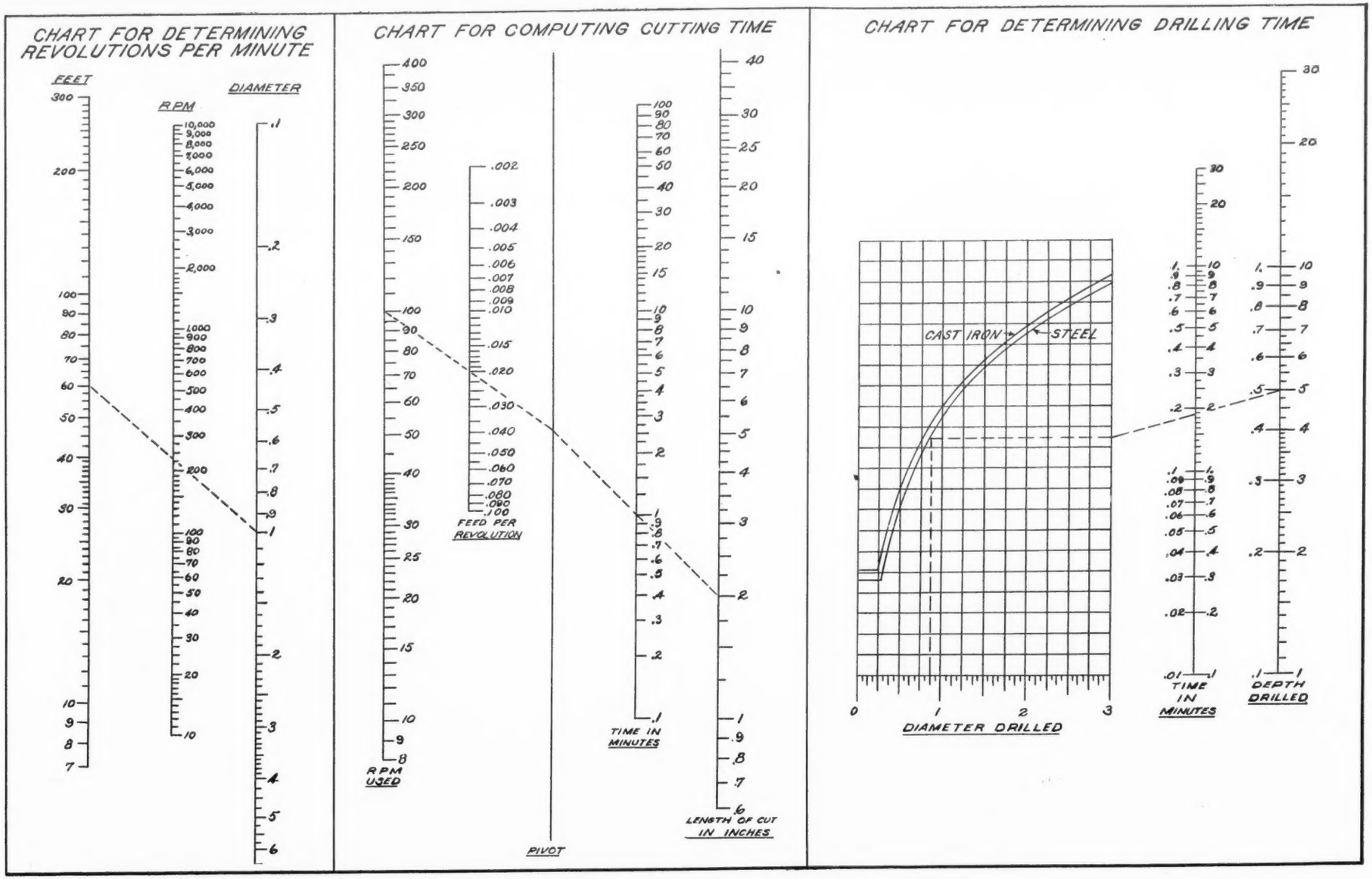


Fig. 4. The Clamping or Bearing Members of Arc-welded Jigs of this Kind can be Hardened in the Usual Way or They can be Hard-surfaced and Ground

* * *

In cases where grinding after nitriding is required, silicon carbide or fine-grained aluminum oxide wheels in relatively soft grades are generally used, according to *Grits and Grinds*, published by the Norton Co., Worcester, Mass. This type of wheel is used because the sharp grains penetrate the hardened surfaces readily and do not generate excessive heat. Specific wheel recommendations cannot be made. However, wheels a grade softer and finer than the wheels used before hardening, but having the same structure number, would probably prove satisfactory.



Charts Used for Rate Setting and Cost Estimating in Shop Production Work

Charts for Rate Setting and Cost Estimating

How the Author Solves Production and Cost Problems Rapidly by the Use of Simply Constructed Charts

By H. H. HERZOG, Industrial Engineer

THE accompanying charts have been used very successfully by the writer for rate setting, estimating, and standard cost work in various plants. The time required for certain operations can be found more quickly by the use of these charts than by the methods usually employed. At the same time, the results are accurate enough for all practical purposes, especially where small-lot production is the rule. Charts of this kind are easily drawn by the aid of an ordinary slide-rule when the required formula is once obtained. A great deal of mental energy is saved by using these charts, which reduce complicated calculations to a mere mechanical process.

The chart at the left in the illustration is used for determining the revolutions per minute for various cutting speeds and diameters. A piece 1 inch in diameter, which is to be turned at a surface speed of 60 feet per minute, is taken as an example. The broken line on the chart shows the method of solving the problem. The number 60 on the "Feet" scale is connected by a straightedge with the number 1 on the "Diameter" scale. It will be seen that the point of intersection of the straightedge with the "R. P. M." scale is at 229, which represents approximately the number of revolutions per minute a 1-inch piece must turn to have a peripheral speed of 60 feet per minute.

Values for other diameters and speeds may readily be solved in a like manner. This chart has many uses in the shop, such as determining the proper speed for certain machines, cutters, reamers, etc., and it is also useful in checking machine set-ups when making time studies. It solves graphically the formula:

$$F = \frac{\pi RD}{12}$$

in which F = peripheral speed, in feet per minute;
D = diameter of piece, in inches; and
R = revolutions per minute.

The chart at the center of the illustration is used to calculate the cutting time when the speed, feed, and length of cut are known. It is of the same type as that shown at the left and solves the formula:

$$T = \frac{L}{RF}$$

in which
T = cutting time, minutes;
L = length of cut, inches;
R = revolutions per min.;
F = feed, in inches per revolution.

A piece 2 inches long that is turned at a speed of 100 revolutions per minute with a feed of 0.020 inch is taken as an example. Under these conditions, it will be seen from the chart that the cutting time would be one minute. It must be remembered here that one minute represents only the actual machining time to which, of course, must be added the time required for placing the part on centers, starting the cut, etc. A simple list of these sub-operations should be worked up for the different machines to suit the individual shop conditions. Such a list will greatly aid the estimator in his work. The writer has frequently used charts of this nature with a list of the manual sub-operations required in setting bonus rates on small-lot production.

If care is taken in arriving at the values for the different elementary operations, surprisingly accurate results will be obtained. In fact, they usually check to within 4 per cent of the best time-study rates. This comparatively small error is greatly offset by the rapidity and low cost with which it is possible to set the rates by means of the charts, one man being able to set from thirty to sixty rates a day.

The time-study man and the foreman will find this chart useful in determining which feed and speed combination will turn out the work the fastest. As a general rule, the best results are obtained by giving the feed preference and adjusting the speed to suit; but often, owing to individual machine limitations, a lighter feed and a higher speed give faster performance. In such cases, the chart may be used to quickly arrive at the best set-up.

The chart at the right in the illustration solves the formula:

$$T = \frac{D}{RF}$$

in which T = drilling time, in minutes;
D = depth of hole drilled;

H. H. Herzog was born in 1899. He received his engineering education at the University of Wisconsin. His specialty is the installation of wage incentive, cost, and production control plans. In this work he has come in close contact with manufacturing in almost every branch of the mechanical industries. At present he has charge of installing a wage incentive system in a large machinery plant. Among the plants with which he has previously been connected are the Western Electric Co., the American Brass Co., the Stewart-Warner Speedometer Corporation, and the Highway Trailer Co. He has been particularly successful in setting incentive rates on small-lot non-repetitive jobs.

F = feed of drill, in inches per revolution; and
R = revolutions per minute of drill.

The values for R and F used in this formula when making up the "Drilling Time" chart give results that have been found accurate enough for most estimating and for the setting of standards in cost work in the majority of plants. The chart is based on a surface cutting speed of approximately 60 feet per minute for mild steel and 55 feet per minute for hard cast iron.

The broken line on the chart shows the method of arriving at the time necessary to drill a 7/8-inch hole either 5 inches or 0.5 inch deep in steel. If the depth drilled is 5 inches, the time required is 1.9 minutes; and if the depth is 0.5 inch, the time is 0.19 minute. In other words, if the right-hand side of the "Depth Drilled" scale is used, the right-hand side of the "Time in Minutes" scale must be used, or if the left-hand side of one is used, the left-hand side of the other must be used. To the time thus obtained must be added the handling time, as explained in connection with the previous chart.

Speeds and Feeds for Carbon and High-Speed Steel Drills

By A. J. SNYDER, Physical Laboratory
Morse Twist Drill & Machine Co., New Bedford, Mass.

THE speeds and feeds for carbon and high-speed steel drills given in Tables 1 and 2 were established under production conditions and will be of value as standard references. Deviations from these speeds and feeds may be necessary, however, to suit certain conditions. Such factors as hardness of the material, depth of hole, lack of uniformity of the material, and method of lubrication all have their effect on the drilling operations and must be considered. These variable factors naturally make it difficult to establish a list of speeds and feeds that will exactly meet every possible condition.

The maximum point pressures and the corresponding torque values for a one-inch forged type high-speed steel drill, when used for drilling brass, cast iron, machine steel, and tool steel are given in Table 3. The results recorded in this table were obtained with a feed of 0.020 inch per revolution and with the speeds best adapted for each material being drilled. The pressure exerted on the point of the drill and the torque in inch-pounds should serve as a guide in designing or selecting drilling machines that will have adequate strength and driving power to meet the requirements of the job to be done.

Table 1. Peripheral Speeds for Drills, in Feet per Minute

Material to be Drilled	High-speed Steel Drills	Carbon Steel Drills
Aluminum	300	...
Brass	200	100
Cast Iron	100	50
Mild Steel (0.2 to 0.3 Carbon)	110	40
Malleable Iron	85	35
Steel (0.4 to 0.5 Carbon)	80	35
Nickel Steel (3.5 Nickel)	65	30
Tool Steel (1.2 Carbon)	60	30
Drop-forging	60	30
Molybdenum Steel	55	25
Stainless Steel and Monel Metal	50	25
Slate	15	...

Table 2. Feeds for Carbon and High-Speed Steel Drills

Size of Drill, Gage Number	Feed per Revolution, Inch	Diameter of Drill, Inch	Feed per Revolution, Inch	Diameter of Drill, Inches	Feed per Revolution, Inch
60–55	0.0005	1/16	0.0015	5/8–11/16	0.009
55–50	0.0010	1/8	0.0025	3/4–13/16	0.010
50–45	0.0015	3/16	0.0040	7/8–15/16	0.011
45–35	0.0020	1/4	0.0050	1–1 1/16	0.012
35–30	0.0025	5/16	0.0055	1 1/8–1 3/16	0.013
30–20	0.0030	3/8	0.0060	1 1/4–1 3/8	0.014
20–10	0.0035	7/16	0.0070	1 7/16–1 11/16	0.015
10–1	0.0040	1/2–9/16	0.0080	1 3/4–2	0.016

Table 3. Point Pressure and Torque Developed in Drilling Various Metals with 1-Inch Forged High-Speed Steel Drill

Material Drilled	Speed, Revolutions per Minute	Feed per Revolution, Inch	Lubricant Used	Pressure on Point, Pounds	Torque, Inch-Pounds
Brass	540	0.020	Lard Oil	500	280
Cast Iron	387	0.020	None	1100	440
Machine Steel	287	0.020	Lard Oil	1200	560
Tool Steel	198	0.020	Lard Oil	2000	1010

Notes and Comment on Engineering Topics

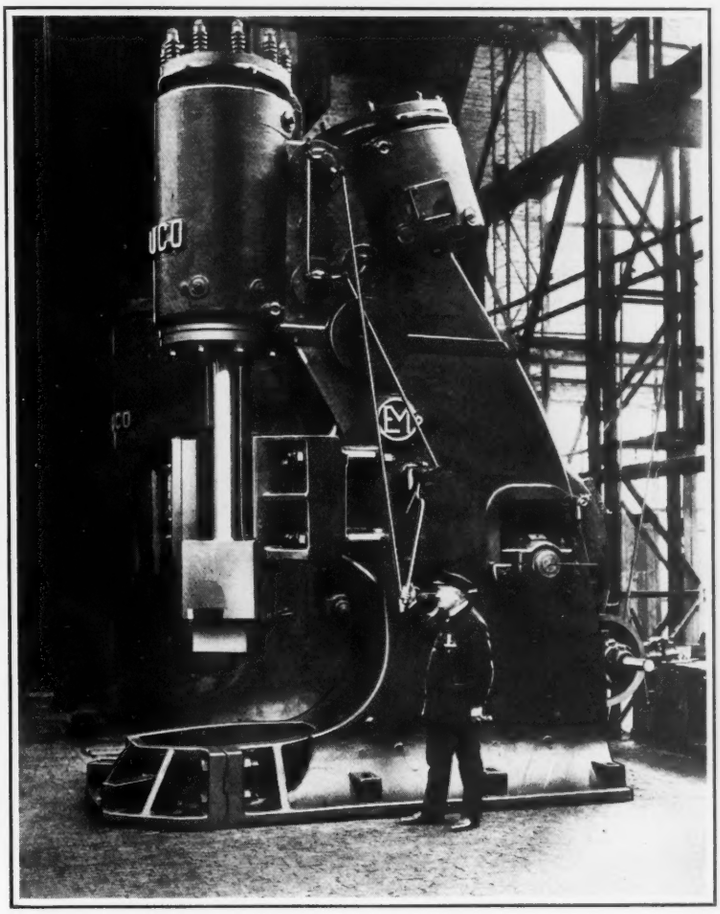
The General Electric Co. has been furnishing locomotives for a portion of the main line of the Transcaucasian Railroad between Baku and Poti, which is being converted to electric operation through a mountain pass, over a distance of thirty-nine miles. The grades over this section range from 1 1/2 to 3 per cent, and regeneration is provided on the locomotives when trains descend the down grades. Eight 3000-volt, 145-ton locomotives have been built at the Erie Works of the company. Two of these locomotives are furnished complete, but motors for the other six are being built in a factory in Russia.

Bearing loads of 20,000 pounds per square inch at a running speed of 420 feet per minute are now possible with sulphurized oil lubrication. According to the *Journal* of the Society of Automotive Engineers, results obtained through research work carried on by the Gleason Works, the General Motors Corporation Research Laboratories, and the Timken Roller Bearing Co., have shown increased bearing load capacity with lubricants containing sulphur and lead soaps. Demonstrations in a Timken lubricant testing machine proved that a straight petroleum lubricant that fails at a load of 10,000 pounds per square inch will, with the addition of 10 per cent sulphurized fatty oil, carry 20,000 pounds or more per square inch.

In searching for a material that will prevent corrosion and act as a protection to pipes, metals used in the building field, etc., the Robertson-Bonded metal has been developed as a result of extensive research at the Mellon Institute, Pittsburgh, Pa. This material is a laminated metal-felt product, in which felted materials are cemented to steel under heat and pressure. The composite laminated material, the outer surfaces of which are of felt, is then saturated with some fluid that will aid in resisting corrosion. Paint, lacquer, and resin films may be added to cover the saturated felt, in order to give added protection and attractive appearance.

The American Society of Mechanical Engineers has published a pamphlet on the American Standard for cast-iron pipe flanges and flanged fittings for a maximum non-shock hydraulic pressure of 800 pounds per square inch gage pressure at ordinary temperatures. The pamphlet may be obtained at 35 cents a copy from the office of the American Standards Association, 29 W. 39th St., New York City.

Depression cannot halt American progress. Research and engineering are daily producing new materials, new devices, and even new industries.—*J. S. Tritle,* vice-president and general manager, Westinghouse Electric & Mfg. Co.



This hammer is claimed to be the largest air hammer ever built. The falling weight is 6600 pounds. The control is unusually sensitive, so that the hammer can be used for the lightest finishing blow as well as for the heaviest forging work. It was built by the Eumuco Works at Leverkusen-Schlebusch, Germany

EDITORIAL COMMENT

A Courageous Texas Farmer Sets a Good Example

There is a story of a Texas farmer that will bear repeating. In one part of Texas this spring a heavy frost killed most of the crops. The farmers stood at the edges of their fields with worried faces. But one man smiled. A visitor asked him: "Mr. Barnes, what are you going to do about it?"

"I have already done it," he replied. "I have ordered another shipment of seed by express. Early tomorrow morning I will be replanting."

This example of old-time pioneer courage needs no further comment.

There Has Been No Depression in the Realm of Ideas

When the future industrial historian looks back upon the present troubled years, he will be unable to record any slackening in the rapid development of the equipment and products of industry. Instead, he is likely to notice a quickening of the pace. It is possible that during no two years on record have so many new ideas been developed into practical shape as in the last two years.

Two industries alone may be taken as examples—the automobile industry and the machine tool industry. There has been no depression in the realm of ideas; perhaps that is because there has been more time to think and the thinking has born fruit. At any rate, the next period in industrial activity will start out from an entirely new base. It will have products to manufacture, either new or improved, and it will have means with which to manufacture them, such as were never available before.

A Leading Industry Decides to Accept a New Responsibility

The news that the National Electrical Manufacturers' Association has approved of the unemployment relief plan advocated by Gerard Swope, president of the General Electric Co., marks the acceptance of a new responsibility on the part of an important branch of American industry. Much has been said and written during the past year on the subject of unemployment insurance and relief. It is therefore certain that American industry will watch with great interest the working out of the plan of the National Electrical Manufacturers' Association, officially designated as "The Nema Mutual Unemployment Benefit Plan." The plan is based upon the principle of mutual responsibility of employers and employes, and under it will be created unemployment relief reserves to which both employers and employes will contribute.

The plan will apply in normal times to about 200,000 workers, and includes employes who have been steadily employed for twelve consecutive months and whose full-time wages do not exceed $2500 a year.

In adopting this plan, an important branch of American industry has decided to do for itself what otherwise would probably be forced upon industry by legislative action. The wisdom of industry in preparing for itself a well defined plan of action rather than waiting for what might be ill-considered legislation is unquestioned.

Volume-Mindedness is a Long Word Well Worth Thinking About

When E. S. Sawtelle of the Tool Steel Gear & Pinion Co. said, in an address before the American Gear Manufacturers' Association, that one of the great difficulties with American industry has been its too pronounced volume-mindedness, he touched upon one of the fundamental factors in our business history. Volume-mindedness has led us into great booms and great depressions. The extremes in one direction have caused extremes in the other.

The idea that to stand still is to go backward, which has many applications in both individual and business life, is not always applicable to volume of business. An enterprise need not stand still because its volume of output remains about the same from year to year. It may be very progressive in the matter of design, quality of product, methods of operation, and the service that it renders its customers. Even its profits may grow materially without a corresponding growth in the volume of annual business.

Volume-mindedness is a word worth pondering upon. There is a point beyond which mere volume is of no particular value, either as regards reduced costs or increased returns on capital investment. To measure business success by mere volume is likely to prove misleading.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Automatic Indexing Head with Self-Locking Mechanism

By OTTO R. WINTER

Automatic indexing heads are used on many special machines having work-tables of the reciprocating type. One design of head particularly adapted for these machines, especially where an unusually large number of divisions is to be indexed, is shown in Fig. 1. The work is secured by some suitable means to the left-hand end (not shown) of shaft *A*. At the end of each indexing movement, the shaft is locked to prevent rotary movement of the work during the machining operation.

The indexing head housing *B* is fastened to the reciprocating machine table. Extending from one side of this head is the shaft *C*, to which are keyed the bevel gear *D* and the forked lever *E*. The forked end of this lever engages a stationary pin *F* secured to the machine, while gear *D* meshes with gear *G*, keyed to the arm *H*. Arm *H* carries a spring-actuated pawl *J* that engages a ratchet wheel *K*, keyed to the bevel gear *L*.

A locking ring *M* is keyed to the ratchet wheel and, as indicated in Fig. 2, engages the plunger *N* in the housing *B*. Cam *O*, which is a thin plate pinned to the arm *H*, disengages the plunger *N* from the locking ring just before each indexing movement. Plunger *N* is wide enough to engage both the locking ring and the cam. To reduce the indexing movement so that a large number of divisions could be indexed, a combination spur and worm gear train was introduced, as indicated by the dot-and-dash lines in Fig. 1. This gear train is operated by the bevel gears *L* and *P*.

Shaft *A* is indexed as the head moves toward the right just before the cutter engages the work, and is idle during the return stroke, while the machining is being done. Incidentally, if the cutter thrust is against the head, these movements should be reversed by mounting lever *E* and gear *D* on the other side of gear *G*. In the position indicated, the head

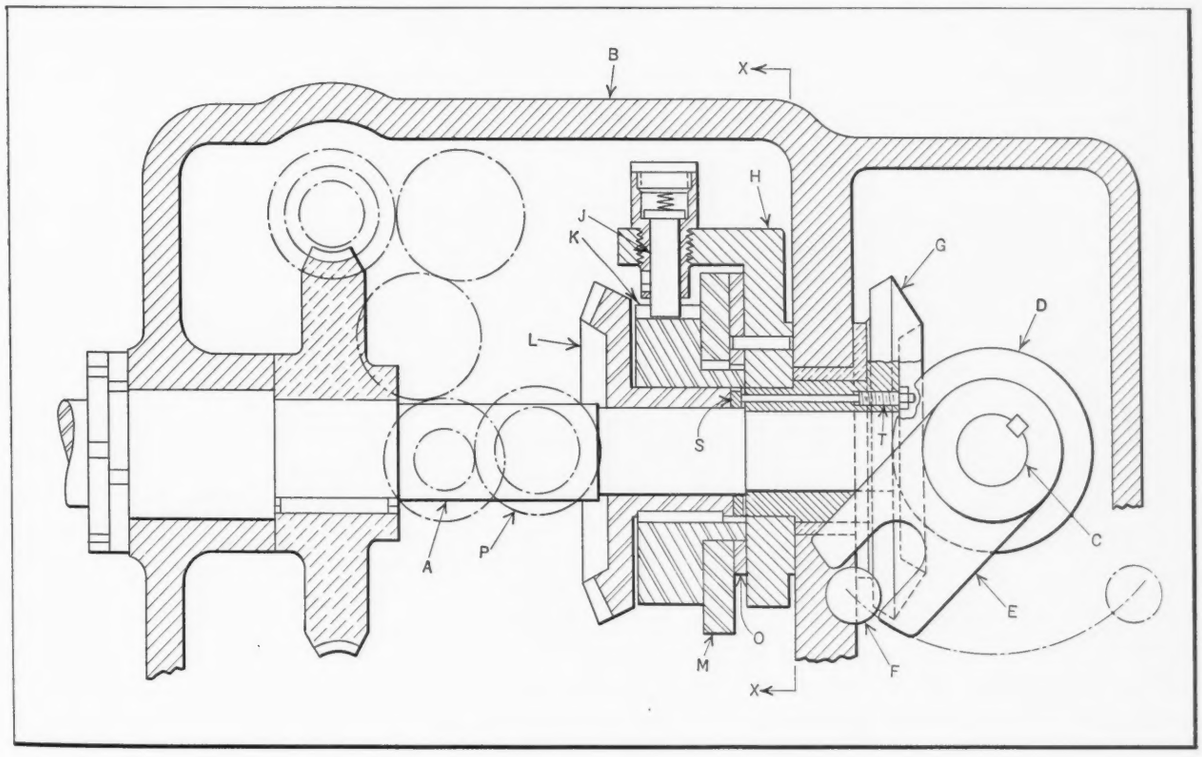


Fig. 1. Self-locking Indexing Head for Obtaining a Large Number of Divisions

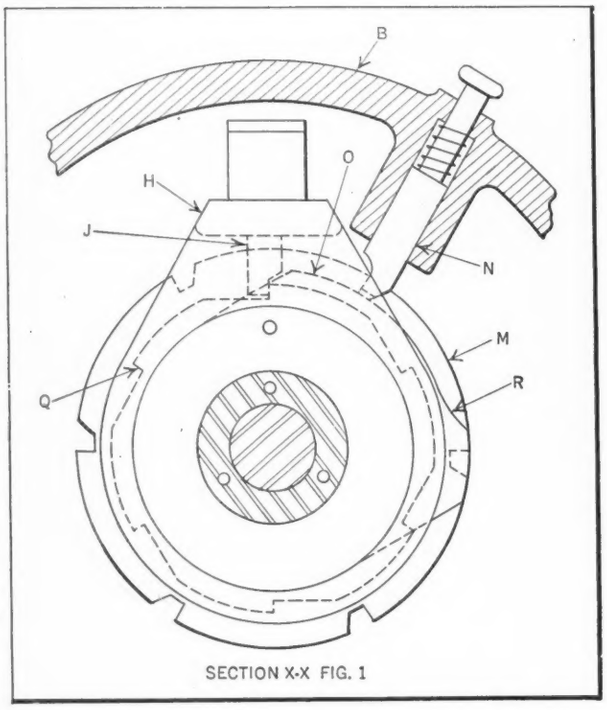


Fig. 2. Cross-section of Indexing Mechanism, Showing Action of Locking Cam

has just completed the end of its indexing stroke toward the right. Now, as the head returns toward the left, the lever *E*, meshing with pin *F*, will be swung in a counter-clockwise direction, causing gear *G* and arm *H* to rotate about 63 degrees.

By referring to Fig. 2, it will be seen that during this movement of arm *H*, pawl *J* will be carried to the left and will engage ratchet tooth *Q*. However, just before pawl *J* engages this tooth, plunger *N* is disengaged from ring *M* by the lobe *R* on cam *O*.

On the return or indexing stroke of the table, lever *E* is swung in the opposite direction (clockwise), causing pawl *J* to rotate ratchet wheel *K*, with gear *L*, one-sixth revolution. This movement of gear *L* is transmitted through the spur and worm gear train, causing the shaft *A* to turn one division.

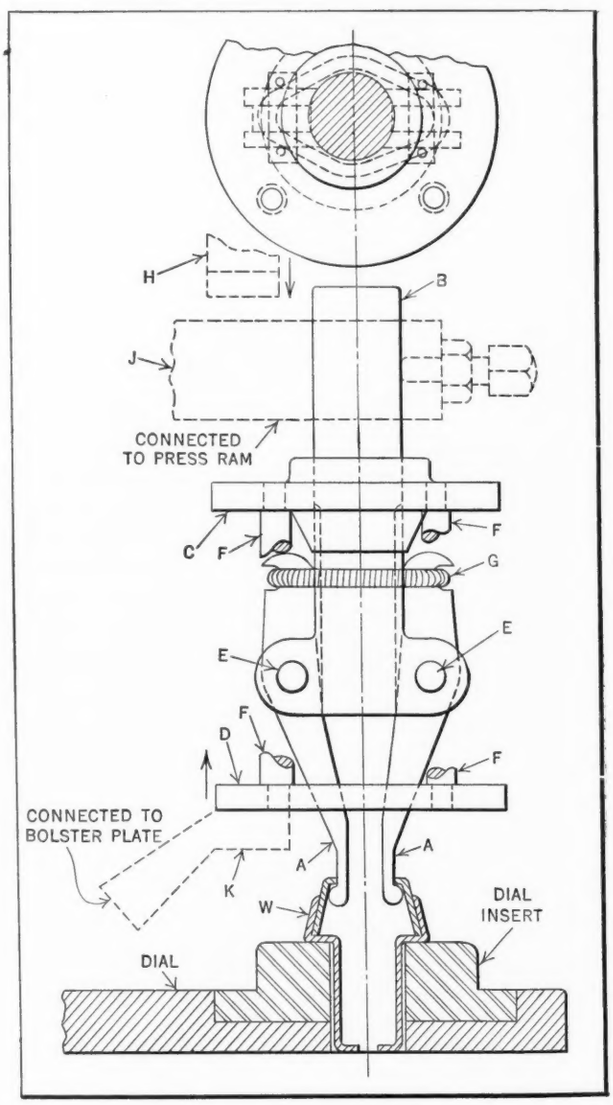
A washer *S*, Fig. 1, is provided to eliminate any backlash in the bevel gears and preserve the accuracy of the head. The backlash is taken up by tightening the screw *T*, thus bringing the gears into closer mesh. The number of divisions obtained with this type of head can be varied by changing the number of teeth in the ratchet wheel, by changing the gears or by varying the throw of lever *E*. This lever, with pin *F*, may be replaced by a rack and pinion.

Ejecting Device for Inclined Power Press

By EDWARD LAY

The accompanying illustration shows a device for ejecting an assembled shell from the dial of an inclined press. The device is attached to the press ram by bracket *J*, which holds the post *B* with the pins *E* on which fingers *A* are pivoted. The operation is as follows: When the ram starts to descend, the fingers *A* are closed at the lower tips, so that they will enter the hole in the work *W*, which consists of two assembled shells. Before the ram reaches the end of the down stroke, the stop *K* pushes the sliding plates *D* and *C* upward. These plates are connected by shoulder pins *F*. The illustration shows the beveled part on plate *C* leaving the fingers *A* so that the spring *G* is permitted to open the lower tips inside the work.

Now, when the ram starts to ascend, the shell is gripped and lifted up out of the dial. Before the ram reaches the top of the upward stroke, the stop *H*, connected with the press frame, pushes plate *C* down. The beveled part of plate *C* then comes in contact with the upper end of fingers *A*, causing the tips to close and allow the work to drop down a chute and slide into a container, thus completing the cycle. The press is operated at a speed of about 75 revolutions per minute.



Device for Ejecting Assembled Part from Dial of Inclined Press

Overload Relief Mechanism

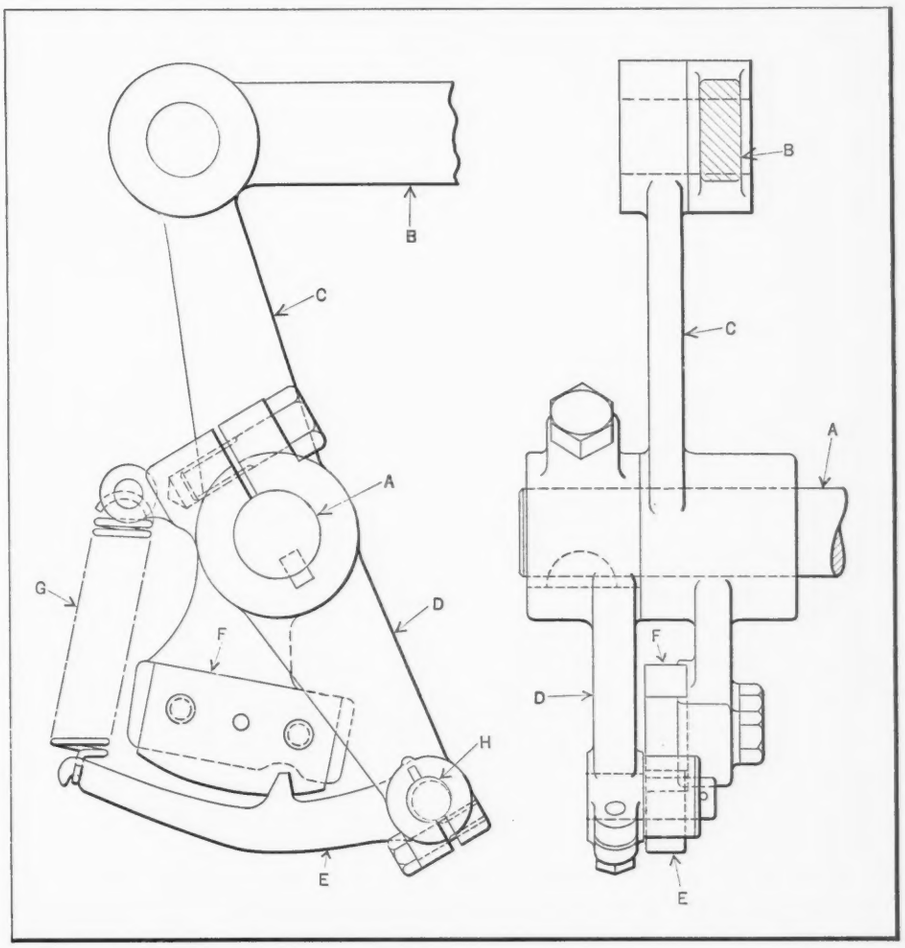
By H. F. SERVER

A feature often overlooked in machine design is the use of automatic releasing members for stopping a mechanism in case of accidental jamming. A release mechanism that was designed for a feed slide subject to jamming but that can also be applied to various types of movements is shown in the illustration.

Oscillating shaft *A* transmits a reciprocating movement to link *B* connected to the feed slide (not shown) through the lever *C*. Lever *C* is a slip fit on the shaft, but is prevented from turning by a locking arrangement consisting of lever *D*, locking bar *E*, locking plate *F* secured to a projection on lever *C*, and spring *G*. At the outer end of lever *D*, which is keyed to the shaft, is pivoted the bar *E*. A tooth in this bar engages a notch in plate *F* and is held in this position by the spring *G*.

Normally, the entire mechanism is locked together and rocks back and forth with the shaft. However, if link *B* becomes overloaded, lever *C* will stop oscillating and shaft *A* will merely turn in the hub bore of this lever. Lever *D*, being keyed to the shaft, will continue to oscillate and cause the tooth on bar *E* to ride out of the notch and slide along the now stationary plate *F*.

The tooth will continue to slide back and forth along this plate and in and out of the notch until the overload on link *B* is removed. When this is done, the tooth will engage the notch and the entire mechanism will once more function as a unit. An eccentric stud *H* is provided so that the angular position of lever *C* can be adjusted to vary the position of link *B* at the beginning and end of its stroke.



Arrangement for Automatically Disengaging a Driving Lever from its Shaft when the Load Becomes Excessive

* * *

Zinc in many forms is invading automotive construction. Perhaps the heaviest tonnage is found in die-castings for many new applications, such as windshield frames, hardware, radiator ornaments, filler caps, etc. A recent study shows that at least 3 per cent, by weight, of a popular car is zinc.

Meeting of Automotive Engineers at White Sulphur Springs

The summer meeting of the Society of Automotive Engineers was held at White Sulphur Springs, W. Va., June 12 to 17. Sessions were held on transportation and maintenance, engines and frames, motor trucks and coaches, headlights, bodies, chassis, Diesel engines, and aircraft. A special session was devoted to research. The papers presented at the meeting clearly indicated the rapid progress that is being made in the automotive field and the advance that may be expected in the future development of the industry. It was quite evident that there is no depression in ideas.

* * *

A correspondent to *Automotive Industries* sounds an important note when he states: "In a subconscious way we feel that the past decade of ruthless individual competition was running counter to the backbone of industrialism, which is cooperation. . . . If it can be shown to the average American that it is good business to look out for the well being of his neighbor, he may not be so reluctant to accept the new doctrine."

The Shop Executive and His Problems

Superintendents and Foremen are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

I find myself in complete agreement with the views expressed by J. S. Drago in his article on page 524 of March MACHINERY. Much can be done to eliminate tedious and useless detail on finished drawings.

Symmetrical parts need only be shown in half-view. On general assembly plans, where there is a repetition of parts, the part should be shown in detail in only one location, the other locations being merely indicated. Where there is only a slight deviation in symmetry, a half-view with the deviating part conspicuously noted, as "left-hand" or "right-hand," will serve the purpose. Piping, wiring, etc., can be best shown by center lines. Excessive cross-sectioning, shading, and other artistic touches, such as cable stranding, are best omitted entirely.

It may be added, in conclusion, that in these days of highly competitive selling, thirty minutes' thought given to the finish to be specified for the manufactured part is worth more than hours given to finishing touches on drawings that the customer never sees.

JOHN F. HARDECKER

Eliminating Employes' Mistakes

Keeping a record of employes' mistakes as a means of reducing spoilage, as described in January MACHINERY, page 336, brought to the writer's mind a novel plan used in a certain shop. This plan embodied both the record plan referred to and another plan used in many large shops that consists of having bulletin boards on which to mount spoiled articles with accompanying comments.

The system was adopted at a time when a man was not likely to be afraid of losing his job through his mistakes, as other jobs were easy to find. The manufacturer, who recognized this situation, hit upon the plan of appealing to the individual's pride as a means of keeping mistakes from being repeated. The method was to set aside a bench near the time-clock in each department and to place on this bench any work that was considered to be spoiled through plain "thick-headedness." At the side of the spoiled work, which bore the workman's name, was placed a typewritten comment on the job. This made the man who had spoiled the work subject to many embarrassing remarks.

This method was frowned upon at first, as it was thought that it might cause trouble between the men. However, it worked out all right, as it resulted in the men striving to keep their names and work off the "torture rack," as they called it. The net result after three months' trial of this plan was a drop of 65 per cent in avoidable spoilage, and no incentive was offered.

Naturally, there were one or two men who resented this plan and who quit, but the plan is now in its third year, and is proving very efficient in keeping the avoidable spoilage at a minimum. This method may appear to many to be out of line with modern management ideas, but the fact is that it accomplishes results and is accepted in a good-natured way by the employes.

CHARLES R. WHITEHOUSE

Freedom in Selecting Methods

Most men have an uncomfortable feeling when they start to work in a new shop. How soon they begin to feel at home depends a great deal upon the extent to which they are given freedom to use their own methods and initiative.

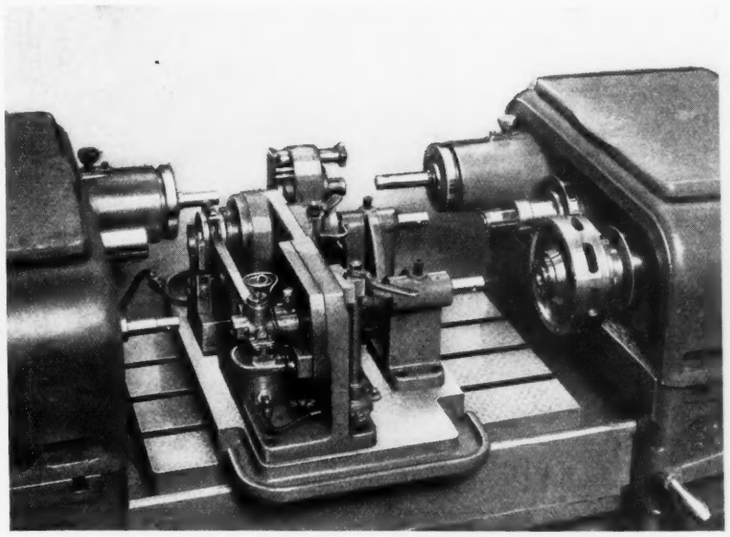
Skilled mechanics are discouraged when they find they have no freedom in selecting methods of work. When the foreman requests a new man to work to instructions, the new employe often makes some such remark as, "At the Blank & Smith shop we always do it this way," with a strong emphasis on the "always." This is likely to irritate the foreman, and the chances are that the reply is, "You are not at Blank & Smith's now, but at Brown & Jones, and here things are done the Brown & Jones way."

It may be that the company would be perfectly willing to have new methods introduced from the outside, especially if they are superior to those in use, but the foreman does not approve of trying new methods. He is likely to be conservative and to want things done his own way. He has good reasons for this; he is held responsible for production, scrap, and costs, and he knows that the established methods will give safe and satisfactory results. If new methods give unsatisfactory results, the blame will fall on him.

Nevertheless, it is suggested that new skilled men should, within reason, be allowed to use such methods as they have successfully made use of elsewhere. They may be able to render better service in that way. In the case of semi-skilled or unskilled men working on production work, uniformly prescribed methods should be adhered to, and changes should be made only with the approval of the foreman.

A. I. COOK

Precision Boring with Diamond and Cemented-Carbide Tools



Improved Methods that Give Better Finish and Higher Production in Machining Bronze, Bakelite, Aluminum, and Similar Materials

MANY manufacturers have experienced difficulty in attempting to machine non-ferrous and molded products with tools of the type ordinarily used for iron and steel. Parts made of these softer materials often become badly distorted under the cutting pressure of the tool and the clamping pressure required to hold them in place. In many instances, it is practically impossible to produce accurate holes in such parts with the usual equipment. A process for handling this class of work known as "borizing," has recently been developed in which use is made of a precision hole-finishing machine known as the Borematic, built by the Heald Machine Co., Worcester, Mass.

The high degree of accuracy obtained by this process in boring holes in parts made of bronze, aluminum, fiber, Bakelite, copper, hard rubber, and other free-cutting materials, as well as in cast iron, has been made possible by the efficient application of diamond and tungsten-carbide tools.

Up to the present time, diamonds and tungsten carbide have been found the most satisfactory cutting materials for these boring operations. The spindle speeds of the machine range from 900 to 5000 revolutions per minute. At such speeds, boring and turning operations can be performed very rapidly with very light feeds that cause practically no deflection of the boring-bar or the work, even though the work has thin walls and is lightly clamped.

A high degree of finish, with exceptionally close accuracy for size, roundness, and taper, is obtained with the diamond or tungsten-carbide tools. These tools leave practically no burrs on the edges of oil-grooves, slots, chambers, etc.

A large number of holes can be finished without resharpening or adjusting tools of this kind. Naturally, both diamond and tungsten-carbide tools cost more than steel tools. However, the saving in time resulting from the larger number of pieces obtained with one sharpening of these tools will net the user a good profit on the original investment.

Diamonds have long been used for machining materials that were too hard to yield to the cutting edges of steel tools, but their use on a large scale for machining the softer materials is a comparatively recent application. Shortly after tungsten carbide became available, it was used in place of diamond tools for machining the various Bakelite compositions. This application proved very successful, and its use was extended to various other materials with equal success. The cemented tungsten-carbide boring tools are used in the form of small cutting tips, brazed into tool-holders, such as shown in Fig. 1.

Generally, tungsten-carbide tools are used dry, no lubricants or

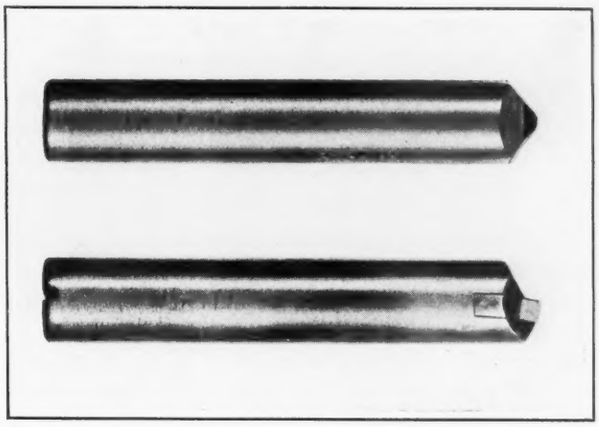


Fig. 1. Top and Side Views of Boring Tool Consisting of Steel Holder with Tungsten-carbide Tip

coolant being required. To obtain the best results, the cutting edge must be lapped to a high polish, so that there will be no grinding marks on the cutting edge, as such marks tend to weaken the tool and prevent anywhere nearly as good a finish from being obtained.

Comparison of Tungsten Carbide and Diamonds

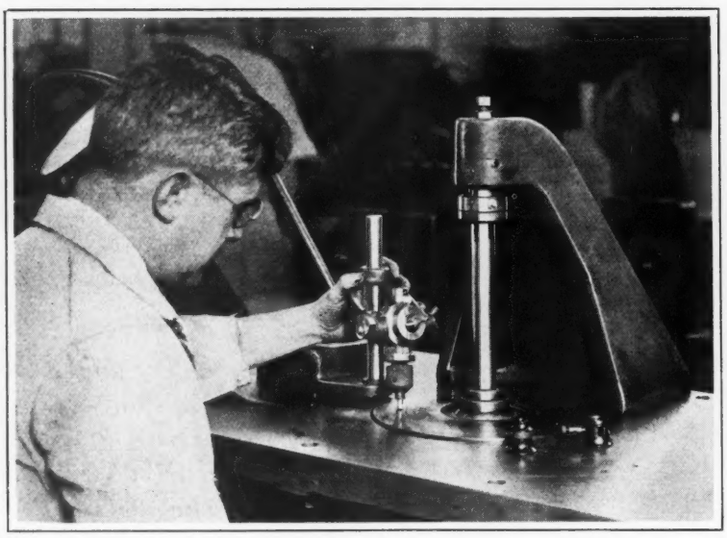
Tungsten carbide, like the diamond, must be used where vibration is held to a minimum. If there is any considerable amount of vibration, the keen hard cutting edge of the tungsten carbide will be destroyed. Tungsten carbide is capable of scratching a sapphire, which is next to the diamond in hardness. It ranks approximately 90 on the Rockwell A hardness scale, while the diamond hardness ranks 100. It is, however, more uniform and dependable than a diamond, and is not so likely to chip. Also, the cutting face and edge desired can be more readily obtained on tungsten carbide when sharpening.

Lapping Tungsten-Carbide Tools

A diamond-cutter's lap is used in shaping tungsten carbide to form cutting tools. The lap used for this purpose consists of a special imported cast-iron disk impregnated with fine diamond dust. The tungsten-carbide tool to be lapped is held in a special holder and presented to the lapping plate as shown in Fig. 2. With this equipment, a skilled operator gradually forms the tool to shape. The cutting edge must have a smooth appearance, even when examined under a microscope.

By honing and resharpening a tungsten-carbide tool before the edge shows appreciable wear, a higher quality of work is obtained and the time charge for each successive sharpening is decreased.

Fig. 2. Lapping a Tungsten-carbide Tool to the Correct Shape for the Boring Operations



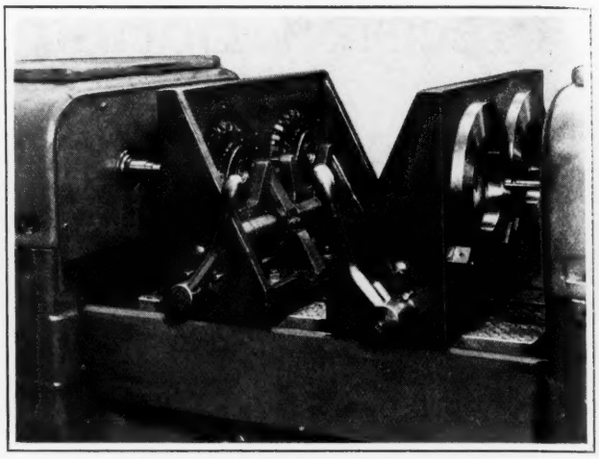


Fig. 3. Fixtures Used in Boring Babbitt Bushings in the End Shields of Motors

In fact, it has been proved that a lapped cutting edge on a tungsten-carbide tool has from two to four times the life of an edge that has been ground only. More important than anything else, however, is the elimination of vibration; this can only be done by the use of a heavy well built machine, especially designed for work of this kind.

Typical Examples of Work Performed on the Borematic

In the heading illustration is shown an interesting application of "borizing" to small-lot production. This particular set-up provides for the economical handling of three different parts. The two spindles at the rear bore two bearing surfaces in opposite ends of a cast-iron tappet guide. The two front spindles in the head at the left of the machine bore the bushings in the large and small ends of a connecting-rod. The bushing in the large end is of babbitt, while the one in the small end is bronze. The connecting-rod is held in an air-operated fixture, being located from the rough bores at the ends.

The two remaining spindles in the head at the right are used for finishing the bore and the outside of rocker-arm bushings. The bushings are mounted on the spindles in this case, while the diamond or tungsten-carbide tools are clamped in fixed positions on the fixture. The chuck on the front spindle holds the bushing while boring the hole to size.

Another interesting application is the boring of bronze bushings at each end of a cluster gear. The bores are finished to a diameter of 0.870 inch for a length of 2 inches. About 0.015 inch of stock is removed at the rate of 96 gears per hour, using two boring stations. The accuracy and finish obtained are such that

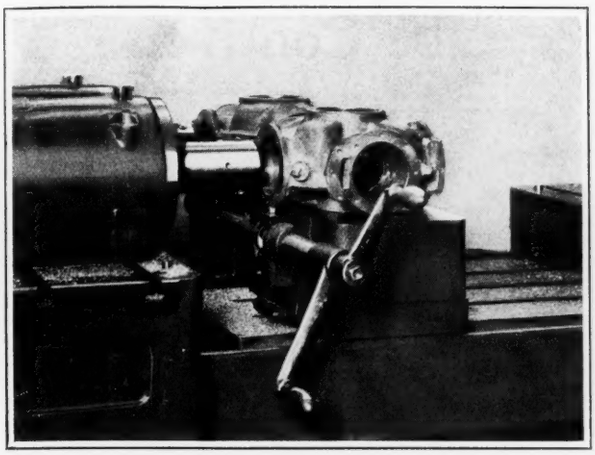


Fig. 4. Indexing Type Fixtures Employed in Finishing Four Bores in Bronze Parts

the extra operation of broaching and burnishing previously required has been eliminated.

The fixture illustrated in Fig. 5 is designed to carry four pistons at each end, although only two are shown. The pistons are located from the bores and bottom faces at the ends of the skirts, and aligned by floating plugs mounted on the sliding member. With this fixture, few parts require changing to accommodate different sizes of pistons, and it is possible to bore several different sizes at the same time.

Remarkable results have been achieved in boring the babbitt-lined bushings of end shields for electric motors. The holes in these parts must be square and concentric with the motor frames, and accurate as to size. The closest limits that could be maintained by the former method of reaming were about 0.0008 inch for size and 0.0005 inch for roundness and straightness. Also, a great deal of trouble was experienced from bell-mouthed holes. A reamer was good for only about 1000 holes and the scrap ran as high as 3 to 4 per cent. Many of the shields had to be returned four or five times to receive new bushings. With the older method, it was necessary to inspect every piece carefully.

The new method of boring these shields with the equipment shown in Fig. 3 gives a production of 200 per hour and has permitted the size tolerance to be reduced to 0.0005 inch. In fact, this equipment consistently holds the work within size limits of 0.0003 inch, and 0.0001 and 0.0002 inch on roundness and straightness. During the first two weeks this equipment was used, not one piece had to be scrapped, and only 10 pieces out of each lot of 500 now have to be inspected.

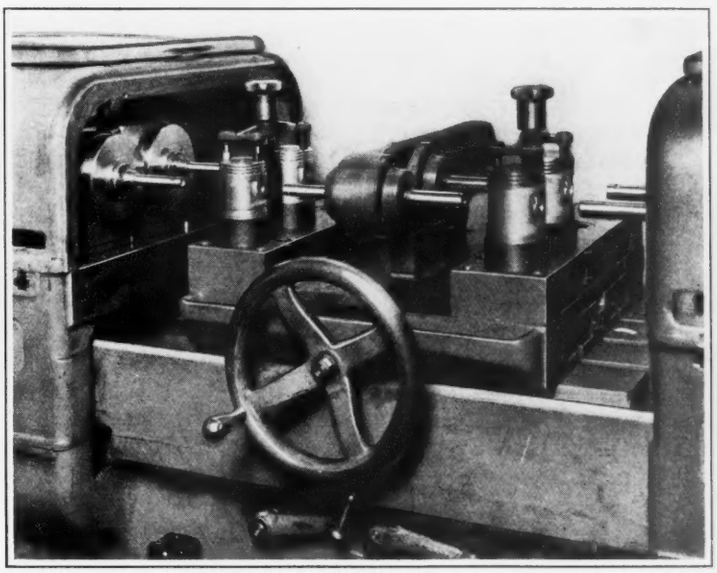
This installation has furnished some interesting data on the two cutting materials used. The two stations at the left in Fig. 3 were equipped with tungsten-carbide tools and the two at the right with diamond tools. The tungsten-carbide tools have each bored 2575 pieces without adjustment, and it is expected that they will need no attention until well over 3000 pieces have been bored. One of the diamond tools, however, chipped after boring 1500 pieces and was replaced by a tungsten-carbide tool. The other diamond tool has bored 2325 pieces without adjustment.

The four bores in bronze gasoline-meter bodies are being machined at the rate of two complete bodies every four minutes with the equipment shown in Fig. 4. With the methods formerly used, two minutes was required to finish-bore and two minutes to hone each of the four holes. Trouble was also experienced in keeping the bores round and free from taper, and within the required limits. By the new method, not only was production increased eightfold, but the honing operation was eliminated.

* * *

The rapid industrial advance of America and Europe during the last fifty years has been due, in a large extent, to active commerce between the various nations. The present efforts on the part of practically all nations to put obstacles in the way of international commerce will hamper and check this development, reduce industrial efficiency, and gradually lower the standard of living. A sane policy applying to international trade is one of the cornerstones in the development of our industrial civilization.

Fig. 5. Type of Fixture Used to Hold Four Pistons while Boring Piston-pin Holes



Tool and Die Makers Take Contracts From Their Own Firm

System of Handling Tool and Die Work on a Contract Basis that Has Proved Advantageous Both to Employer and to Employes

By B. C. BOOTH
Superintendent, Radio Division, Brunswick Radio Corporation, Muskegon, Mich.

INCREASED earnings for both the company and the workmen have resulted from handling tool and die work under the contract system to be described. This system was adopted at the beginning of the past year when new models were released for production and the company began its campaign to keep expenses down. Our die shop, which is not large, ordinarily employs twenty tool and die makers, although the number may be increased by ten or more day workers and a night crew when tooling up for a new job.

As our production is of a seasonal character, we have a slack period each year during which the new models and the subsequent tooling equipment are produced. In previous years, part of our tool equipment was purchased from outside concerns two or three hundred miles distant. This was rather an unsatisfactory arrangement, as changes and corrections in engineering details proved costly and deliveries could not always be made as scheduled.

To eliminate these difficulties and to keep expenses down, we decided to let our own die and tool makers take the contracts for all of the tool equipment we required. The procedure followed was to have the die room foreman, the diemaker or diemakers, and the superintendent hold a round-table conference on how the dies were to be built. These data were written up in triplicate on a multigraphed form. After the estimating department had determined the number of hours of work required for the job, and entered the time on the forms, one copy was sent to the workman, one to the tool-room foreman, and one to the payroll department.

How the Actual Contract is Let to the Diemakers

The method of checking the number of hours required was for the diemaker to bid on all the tooling needed to produce the part according to the blueprint and the description on the contract form. If this bid was within the estimate already made, he was given the contract. If not, another diemaker was asked to figure on the job or another meeting was held to find out what was wrong and to change the tools or design other tools so that they could be made within the estimated time.

The contractor took the job to make all the tools required to complete the part—not just those for one operation. Thus, one contractor could not blame another because his formed or drawn part was not right. On some of the larger jobs, there were several men on one contract. All estimates were based on the number of working hours required, so that men who were paid at different rates could work on the same contract.

For instance, five men took the contract for making the tool equipment for producing a flanged cup requiring dies for blanking and drawing, second drawing, piercing, and trimming, notching, and boring. Three of these men were on day work and two on night work. One man was a lathe and grinder man and one was an apprentice. This group took the contract at 740 hours time. Their actual time was 680 hours, so that they made twelve hours time apiece on the job. Four different hourly rates were paid on this contract.

The contract was considered fulfilled when the tools had produced 500 finished parts that were accepted by the inspection department and when the tools had been approved by the die-room foreman.

Advantages that are Claimed for the New Method

The advantages of this system may be summed up as follows: First, the tools can be tried out in the machines in which they are to be used and under actual operating conditions; second, close control of delivery is obtained; third, full use is made of the tool-room equipment required for maintenance during peak production at a time when this equipment is idle; fourth, the interest and enthusiasm of the employes is aroused, so that when they go to the tool-crib for a drill, they will remember to get the tap, counterbore, and reamer at the same time, and they will also be more anxious to find the fastest practical speed of the machines used; fifth and most important of all, the tool costs are kept within predetermined figures.

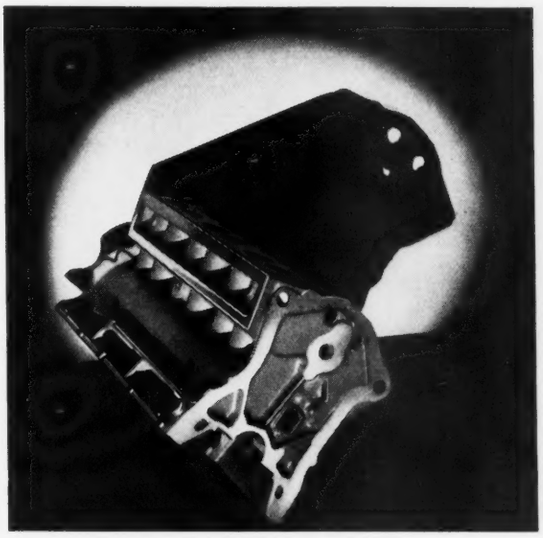
Obviously, the management is very well satisfied with the "contract system," and the men are pleased with a system that increases their income.

* * *

The Machine Shop Practice Division of the American Society of Mechanical Engineers has decided to hold a meeting at Buffalo, N. Y., during the week beginning October 3, in conjunction with the National Metal Congress and Exposition held in Buffalo at that time. The American Drop Forging Institute will also hold a meeting in Buffalo at the same time.

Economical Milling Procedure Developed by Engineering Study

By Careful Planning, A Marked Increase in Production Has Been Obtained in Milling Cylinder Blocks for Lycoming V-Type Automobile Engines—First of Three Articles



THE methods and equipment described in this article and in the two articles to follow are employed by the Lycoming Mfg. Co., Williamsport, Pa., in the manufacture of V-type engines. The machines and special equipment described in these articles form part of the complete milling installation for the major operations on those parts that are put in production first, namely, the cylinder block, shown in the heading illustration, and the cylinder heads for this block.

The practice exemplified by these new installations is the result of a careful study made by the builders of the machines and tooling equipment—the Cincinnati Milling Machine Co.—working in close cooperation with the production department of the engine manufacturer. The majority of the newly installed machines are equipped with hydraulic table feeds. Many features of these machines are protected by U. S. and foreign patents.

Advantages of Unit Construction Employed for Machines

A great variety of machines covering the range of almost any milling job can be built or assembled quickly from the standardized units incorporated in the milling machines illustrated in this series of articles. The unit construction also permits the machines to be easily adapted for new operations of a widely different nature.

An interesting sidelight on the unit construction idea is the fact that two machines, one of which is shown in Fig. 1, were originally built three years ago. By the substitution of new spindle carriers for the original ones, these machines were brought up to date and made fully capable of performing their work efficiently in the new line-up of equipment.

An outstanding feature of the milling equipment described is the application of cemented tungsten-carbide tipped cutters wherever economy justifies their use. The engine manufacturer for whom these machines were built is one of the most extensive users of cemented-carbide cutters in the automotive industry, and has been using such cutters successfully for a period of over a year and one-half.

Stellite cutters are also used wherever their application proves the most efficient means for taking the required cuts. In some instances, where cuts are taken on several surfaces simultaneously, great economy is obtained by using cemented carbide for milling certain surfaces and Stellite for other surfaces. The use of the new cutting materials in combination with high-speed steel cutters has also been found most economical in certain cases.

The fixtures used on the machines for milling cylinder blocks are all of the conveyor type, which permits the work to be rolled into position from the floor conveyors and rolled out again after the machining operation is completed. In some cases, the work passes directly through or over the machine table. In other cases (as illustrated by Fig. 1), this is not practicable and the fixtures are loaded and unloaded from the end of the table, turntables being set in the conveyor line to facilitate the transfer of the work to and from the conveyor. The fixtures have been designed to reduce the loading and unloading time to a minimum and to require the least amount of effort for loading and unloading.

Future Requirements Considered in Planning Equipment

The actual production requirement is five engines per hour, which means five cylinder blocks and ten cylinder heads. The equipment was laid out to obtain this production with the minimum total cost, including, of course, direct labor and amortization, and the use of a minimum number of machines consistent with this principle.

The machines of the size used for this work are actually capable of a much higher production rate. By increasing the number of operators on the complete line, the production can easily be increased to 192 blocks per sixteen-hour day. Some of the ma-

chines in the cylinder-head line are so arranged that production can be increased by the addition of other heads and the use of duplicate fixtures.

Another factor taken into consideration was the customer's possible need for machines capable of handling cylinder blocks and cylinder heads for engines of greater size, particularly greater length, than the ones being built at the present time. For this reason, some of the machines appear much longer than necessary.

The feeds used at the production rate of five engines per hour are much lower than the maximum rates possible. This, however, gives the cutters longer life and reduces the time required for grinding and changing cutters.

The first operation on the cylinder block is performed on the machine shown in Fig. 1. This consists of rough-milling the bottom or oil-pan surfaces and rough-milling the large slot and seats for the crankshaft bearing caps. The piece is conveyed into the fixture on the rollers shown at the front of the fixture base. The work is raised off these rollers and moved forward and upward by a mechanism actuated by a single lever. The piece is first squared up against three fixed side supports by the action of a side clamp.

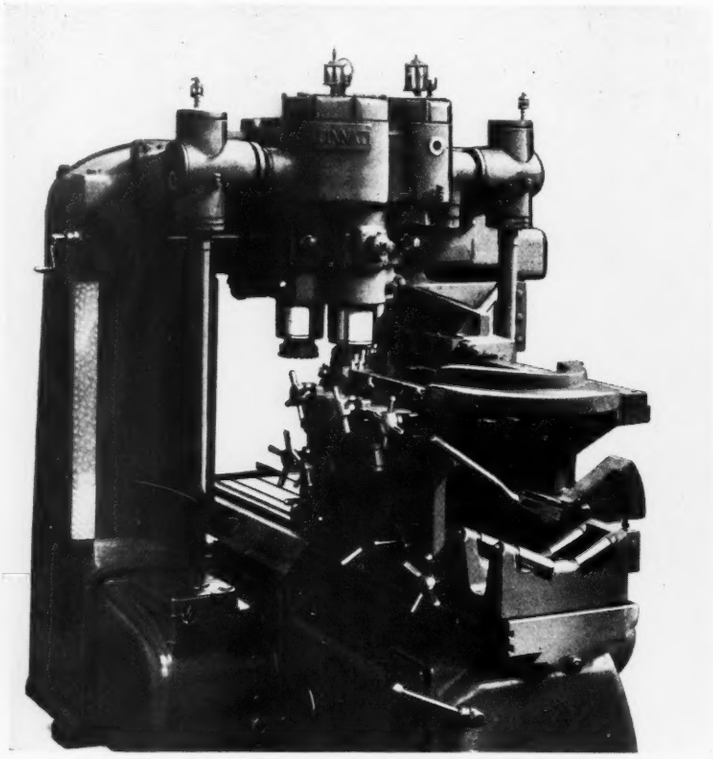


Fig. 1. Machine Equipped for Rough-milling Oil-pan Face, Cap Seats, and Bearing Locks of Cylinder Block for V-type Engine. These Surfaces are Finished in the Second Operation on a Similarly Equipped Machine

The vertical location is established by two fixed supports under one flange. One side of this flange is also supported at the center by an adjustable jack. The other side of the flange rests on three adjustable supports which are incorporated in the three pinch-type hold-down clamps. A clamp at each end of the crankshaft bearing also helps to hold the work down. The total time for removing and replacing a piece is 1 1/2 minutes.

Since the cutting takes place approximately 25 inches above the top of the table, and since the action of the cutters tends to tip the work over, the fixture is provided with a guide that is as high above the table as possible. This helps to provide the rigidity that is an essential feature in operations where tungsten-carbide cutters are used. The two cutters on the two outside spindles of the three-spindle head are tungsten-carbide tipped, while the adjustable cutter on the central spindle which mills the bearing lock is made of Stellite. As the Stellite cutter mills surfaces about 2 1/2 inches deep, the cost of a tungsten-carbide tipped cutter for this length of cut would be prohibitive and the cost of grinding such a cutter would be extremely high. Again, the need for tungsten-carbide tips on this cutter is not so marked as it is on the cutters for the flanges, which are of rather thin section and hard.

The machine shown in Fig. 1 is equipped with a variable-feed attachment provided with a cam that automatically varies the feeding rate during the cut. The feeding rate is varied from a maximum of about 18 inches per minute when only the tungsten-carbide cutters are cutting to a minimum of about 12 inches per minute when the center cutter is rough-milling the bearing lock. The variable-feed attachment, therefore, accounts for a saving in time of approximately 35 per cent, and also reduces wear on the Stellite cutter.

The production obtained with this equipment is twelve pieces per hour at the feed rate used, although the actual requirement is only five pieces per hour. The machines are sufficiently powerful and rugged to use feed rates beyond the capacity of the cutters, which are the limiting factors in this case. Maximum economical production from the standpoint of cutter life would be about fourteen to fifteen pieces per hour.

Equipment for Finish-Milling the Cylinder Block

The second operation, consisting of finish-milling the bottom flange and bearing lock, is done with a machine and fixture exactly like those used for the first operation. The variable-feed attachment is used to vary the feeding rate between 12 and 18 inches per minute. This machine and the one used

for the first operation were originally supplied three and one-half years ago for a similar operation on another cylinder block.

These machines were originally designed for high-speed steel cutters, but were later changed to use tungsten-carbide cutters. It was a simple matter to change the pick-off gears to give the proper speed for driving the tungsten-carbide cutters. The machines have been operating for about a year with the tungsten-carbide cutters and have given extremely satisfactory results. Only minor changes were required to adapt the machines for the work now being performed.

Following the rough-milling of the oil-pan faces and the bearing lock, the cylinder block passes to a special drilling machine on which two master locating holes are drilled and reamed in the oil-pan flange. The location of the block for subsequent operations is, in almost every case, made from the finished bottom surface and the locating holes.

The third milling operation, or the fourth operation on the cylinder block, consists of milling the two water-jacket pads and rough-milling the tops or seats for the cylinder heads. One cut suffices for the water-jacket cover faces, while a subsequent operation is required for finishing the seats for the cylinder heads.

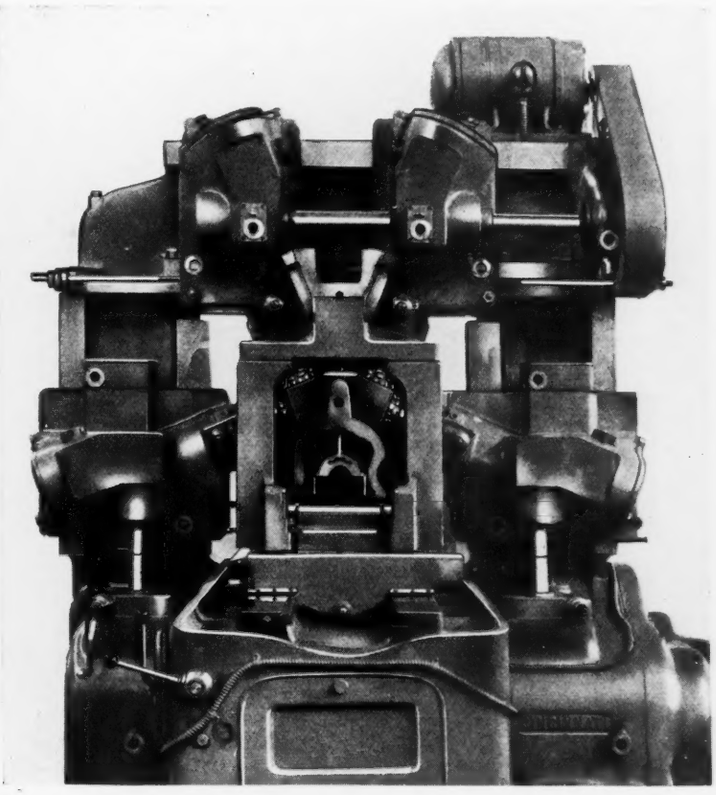


Fig. 2. Specially Equipped Hydromatic, Taking Four Cuts on Cylinder Block. The Rough-milling of the Two Surfaces for the Cylinder Head and the Milling of the Water Jacket Faces are Completed in One Cut

In this operation, the work is rolled into the fixture shown in Fig. 2 on the tops of conveyor rollers, and is then located approximately by suitable guides and a stop. The rollers are now lowered by the operation of a single lever until the work rests on hardened steel locating ways with two hardened steel dowel-pins in the locating holes. The piece is securely clamped by two screw-operated clamps located in the top rail of the fixture. These clamps are tightened and loosened by means of a reversible air-driven wrench suspended from the ceiling. With this arrangement, the time required to remove and replace one piece is about 1 1/4 minutes.

The fixture is guided at the top to eliminate vibration. All four cutters used for this operation are of tungsten carbide, and the machine is of unit construction. The spindle carriers, although special, with the exception of the main casting and certain details, are composed of standard items such as quills, quill adjusting brackets, speed change-gears, etc.

Since the area of contact between the cutters and work remains constant, the variable-feed attachment is not used in this operation. The feeding rate is 13 inches per minute, giving a production of twelve pieces per hour. The machine itself is capable of driving the tungsten-carbide cutters considerably beyond the point of economical operation. It is estimated that the limit for economical operation of these cutters is approximately sixteen pieces per hour.

The equipment used for succeeding operations on the cylinder block will be illustrated and described in a forthcoming number of MACHINERY.

* * *

The Engineers Club of Philadelphia, together with affiliated engineering societies, has organized the Philadelphia Technical Service Committee for the purpose of bringing together executives requiring technical assistance and unemployed engineers. The club also works in cooperation with the State Employment Commission. Over 600 trained men are registered with this committee at present, including plant executives, managers, production engineers, designers, chemists, sales engineers, etc.

Manufacturers and others needing technical assistance are invited to communicate with the committee at the Engineers Club, 1317 Spruce St., Philadelphia, Pa. The service is rendered without cost and all communications are regarded as confidential. The committee is willing to assist other sections of the national engineering societies in organizing similar local services.

Indenting in a Power Press by the Spot-Welding Method

By AVERY E. GRANVILLE

A rather novel application of the spot-welding method is shown in Fig. 2. Here the heating equipment is being used on a coining press of the dial type to heat the parts and make them soft, so that they can be readily indented. The parts are made of 1350 SAE steel, and serve as caps for rotary pumps. Each cap, as illustrated in Fig. 1, has two fluid ports with a depth and width of about 5/32 inch. The ports in two of these caps are indented during each cycle of the press.

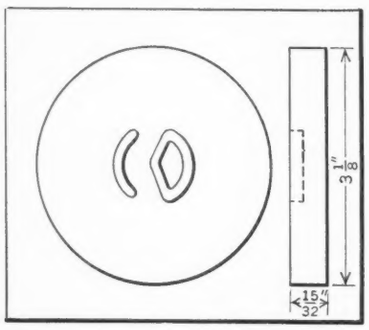


Fig. 1. The Fluid Ports in this Pump Cap are Indented in the Press Shown in Fig. 2

For each indexing movement of the dial (see Fig. 2), two caps slide forward over two electrodes secured beneath the dial. Directly above these electrodes are two other movable electrodes *A*.

As the ram descends, electrodes *A* come in contact with the central portion of the two caps and set up a resistance which heats the caps to a bright red. As the ram ascends, the dial is indexed, carrying both caps under the punches *B* by which they are indented. When the dial has carried the indented parts around to a certain point, they drop from the press by gravity.

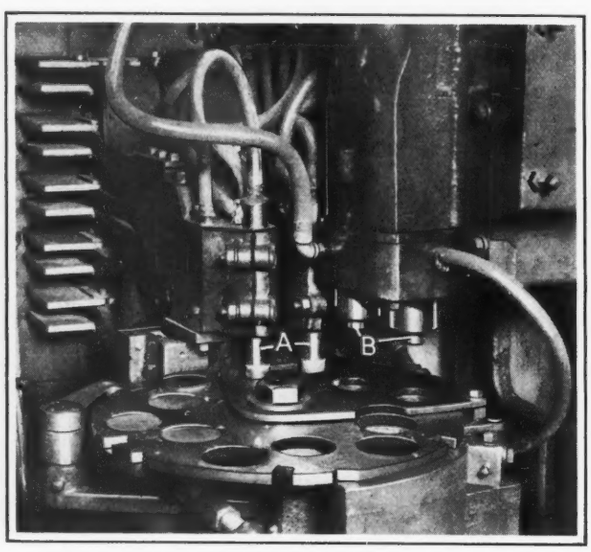


Fig. 2. Power Press in which Part Shown in Fig. 1 is Heated between Electrodes to Facilitate Indenting the Fluid Ports

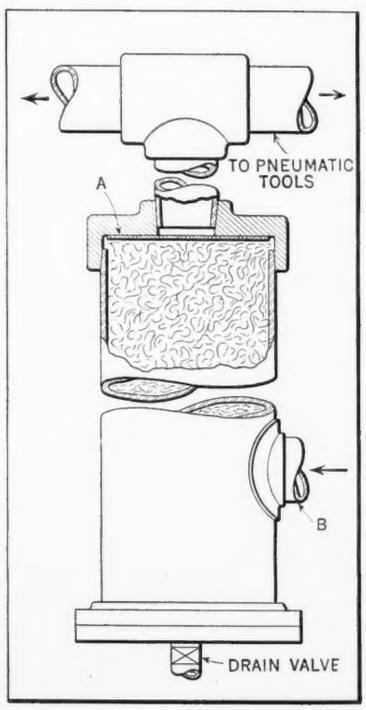
To prevent the punches from losing their temper, provision is made for water-cooling them through the flexible tube at the right. The speed of the press is reduced to about four strokes per minute, in order to allow sufficient time for the electrodes to heat the caps. As two caps are completed at each stroke, this gives a production of eight caps per minute. Although apparently slow, this method is far more rapid than if the parts were end-milled.

* * *

Separator for Filtering Compressed Air

By F. C. MASON

Oil, water, and dirt are removed from compressed air by means of the separator here illustrated. This device is of simple design, consisting of a length of iron pipe packed with excelsior. The diameter of the pipe varies according to the amount of air required. The lower end is sealed by a blank flange equipped with a drain valve.



Separator in which Excelsior is Used for Filtering Compressed Air

Air is admitted from the supply line at opening *B*, which is located near the bottom of the separator. Since the excelsior is packed loosely into the separator, a 1/8-inch mesh screen *A* is provided to prevent it from being blown out. The separator is covered by a reducing flange, in which is screwed the pipe for delivering the clean air to the pneumatic tools.

Excelsior absorbs oil readily and it will last a long time before it needs to be renewed. This material also collects dirt particles and water. Liquids which are not absorbed by the excelsior drop to the bottom of the separator, where they may be drawn off at intervals. However, an excessive quantity of oil passing through the drain valve indicates that the packing is saturated and requires renewing.

* * *

The engineer has given us the machine, and in so doing has performed a great service. If we are not able to make proper use of the services thus placed at our command, do not let us blame the machine for our shortcomings.

The Designer Has a Wide Choice of Materials

Substantial Savings in the Cost of Irregular-Shaped Parts are Secured by Exercising Care in the Selection of Materials and Production Methods

By JAMES VINCENT

THE designer could assist the production engineer considerably, if, when working on the drawings of irregular-shaped parts, he were to consider more fully the methods of manufacture. Frequently the form of a part is determined by the first impression made on the draftsman's mind as to what is required. Probably advantages would be gained if the draftsman would consider a list of the possible ways of producing the part, such as the following, before deciding upon any design: Die-casting; molding; pressing; the use of extruded and rolled sections; welding; riveting; and sand-casting.

Alloys Adapted for Die-Casting

Die-castings may be made either of a zinc-aluminum or a zinc-tin alloy, an aluminum-base alloy, or brass. These are given in the ascending order of strength. For ordinary work, when great strength is not necessary, the zinc-base alloy is preferred, since it can be produced more cheaply and the molds or dies do not wear out so quickly, because the temperature of the casting is lower. Parts requiring greater strength are made from one of the numerous aluminum alloys which are becoming quite popular.

Although it is possible to make brass die-castings when the form is relatively simple, the commercial application is rather limited. The great trouble with brass is that the temperature of the metal is so high that the surface of the mold, even when chromium-plated, is easily broken down, resulting in high tool charges.

A point of interest to the designer is that the accuracy obtainable in die-castings is greatest with zinc-base alloys. Tin alloys are used for die-casting, but owing to the higher price, are not employed extensively. These alloys may, however, be considered when small parts requiring a very high degree of accuracy are necessary.

Bakelite and Other Molded Parts Have Wide Application

Molding is a process that, in many instances, competes with die-casting. Today molded parts have become almost synonymous with Bakelite. Recently, however, what is known as the injection process of molding, employing either cellulose acetate or nitrate, has become used to some extent. The most important claim of this latter process lies in the speed of operation. It is said that small parts likely to be required in large quantities can be made cheaper by the injection process than from Bakelite compounds. The mold cost is, however, higher—roughly 100 per cent.

Moldings of cellulose acetate or nitrate are affected by heat, but this, in particular instances, may be an advantage rather than the reverse, since it enables slight forming to take place after molding, which may facilitate assembly work. Molding in ebonite or similar rubber-base plastics is still used to a large extent, but is likely to be costly.

Brass May be Selected because It Can be Drawn Easily

It is hardly necessary to enlarge on the question of pressed parts, since the possibility of using them always presents itself to the mind of the designer. However, in an attempt to economize, black plate or steel strip is sometimes specified when, actually, it is costly to use these materials because of the higher production costs. Frequently the use of soft brass may lower the price of the job as a whole, because it can be drawn more readily, thus eliminating annealing operations.

Extruded and Rolled Sections are Obtainable in Many Shapes

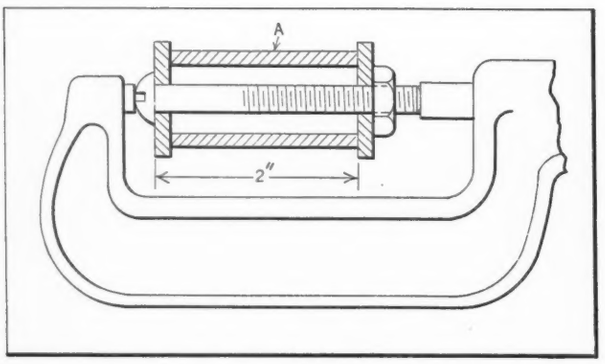
Extruded sections are not used so extensively as they might be were fuller advantage taken of the standard charts supplied by manufacturers. T-shapes, U-shapes, and numerous other irregular sections are stocked, or at least delivered within a short space of time. Extruded brass is a very useful material.

Ebonite rod, now to a large extent replaced by Bakelite moldings, may still, on occasion, be found advantageous for manufacturing, since it can be obtained in a variety of shapes. Sometimes complete parts are produced by simply parting or cutting off sections of these bars having the required shape.

Rolled sections are stocked in very large varieties. Brass sections, for instance, are obtainable in an astonishing number of different shapes. Again, most of us, when thinking of tubular stock, have in mind the cylindrical tube, but tubes of both steel and brass are provided in numerous shapes. A square tube, for instance, may often be slit into parts, eliminating welding and riveting operations.

Of late years, small castings of iron, brass, or bronze have dropped out of prominence, being replaced to a large extent by pressed parts. It is not always fully appreciated, however, how really cheap small iron castings may be, and how accurately they can be produced when mechanical molding is used.

Another point of importance to the designer of irregular parts is the method of finishing. The



Method of Measuring Elongation of Machine Screw after Tightening Nut

tendency today is to give more time and attention to the finishing operations. Customers today are not satisfied with the simple black enamel used a few years ago. Instead they demand polished electro-plate, nickel oxides, or some color finish. All finishing is expensive, and whenever polishing is essential, the cost of finishing is often quite high.

Referring now to the manufacturing methods, we find that the use of molded parts is particularly economical from the point of view of finish, because the parts have a good finish when they come from the mold. Further, the color or grain may be altered by a simple change in the molding mixture employed, which does not necessitate special tools or operations.

* * *

How to Avoid Overstraining Screws

When power-driven screwdrivers or wrenches are used in assembling lines for tightening machine screws or nuts, the friction drive or other slip arrangement which determines the maximum tightening torque can easily be set to overstrain the screw, so that nearly every screw may be just on the point of breaking. A simple method of checking the torque setting of power screwdrivers is to use a testing fixture such as shown at *A* in the illustration above.

After measuring the length of the screw with a micrometer, as illustrated, the nut or screw is tightened with the power screwdriver and the length measured again. The difference in the measurements should not exceed 0.0017 inch per inch of effective length for steel, or 0.0034 inch for brass. As the effective length tested in the fixture is 2 inches, the difference in measurements for a steel screw should not exceed 2 $\times$ 0.0017 or 0.0034 inch.

* * *

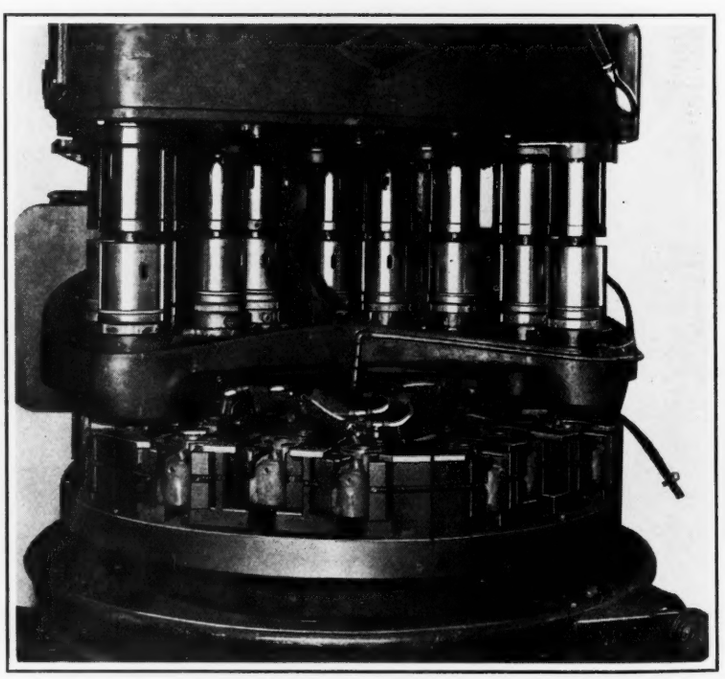
The man who lacks confidence in his own ideas often finds them patented years after by someone else.

High Production with Pneumatic Fixtures

On the machine illustrated, six pneumatic cylinders clamp the work in eighteen fixtures. This equipment is used at the plant of the Bendix-Stromberg Carburetor Co., South Bend, Ind., for rough-boring and rough-finish-boring the throttle valve hole in carburetor bodies and, at the same time, rough- and finish-facing the flange. The hole is 4 1/2 inches deep and must be finished to between a minimum diameter of 1.664 inches and a maximum diameter of 1.670 inches. The flange is 3 3/4 inches wide. A total of 1/8 inch of stock on the diameter is removed in boring and a depth of 1/16 inch in facing.

Through the use of the pneumatic clamping fixtures, an indexing table, and tungsten-carbide boring tools, which are inserted in spindles that are operated semi-automatically, a production of 146 castings per hour is obtained. Each tool-head is equipped with a boring-bar having two tungsten-carbide bits for boring and six radially arranged high-speed steel blades for facing. Accurately bored holes are assured by pilots which run in bushings in a guide plate clamped above the machine table.

There are twelve tool-spindles, six of which are used for taking the rough-boring and rough-facing cuts, and six for the semi-finish boring and finish-facing cuts. The machine table indexes 120 degrees between each vertical movement of the drill head. The indexing is effected manually, while the fixture clamps are opened and closed by merely operating a valve handle provided for each two cylinders. The clamps are opened or closed on each group of six work fixtures by a hand-operated air valve, for unloading and loading.



Air-operated Fixtures, an Indexing Table, and Tungsten-carbide Tools Increase Production in Boring and Facing Carburetor Bodies

Special Tools and Devices for Railway Shops

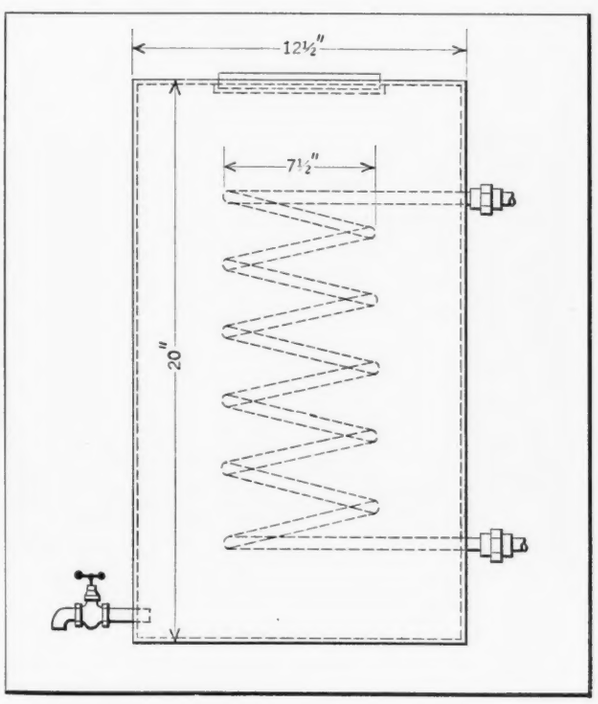
Recommended by Railway Shop Superintendents and Foremen

"Penetrating" Oil for Removing Tight Nuts and Studs

By EDWIN G. JONES
Atlantic Coast Line Railroad, Tampa, Fla.

There are many instances in railroad shops, as well as in other repair shops, where the removal of tight nuts, studs, and bolts causes considerable trouble and delay, owing to the corrosion of these parts. In many cases, tight nuts are cut away from their bolts or studs by means of a chisel or an acetylene cutting torch, making them unfit for further use. Tight studs or bolts are sometimes "burned" out by means of the acetylene torch and the hole is then retapped.

In the shop where the writer is employed, this practice is eliminated by the use of "penetrating" oil. A small quantity of this oil is applied to the threaded member with an oil-can and left to penetrate for a few minutes, after which the nut or stud is easily removed. There are, however, some instances where the desired results require a longer period of time, and frequently the penetrating oil has to be applied a second time and the work hammered so as to loosen the scale and quicken the penetrating action. The most useful applications for penetrating oil in a locomotive shop are on nuts and bolts in the smokebox and on air-brake appliances.



Carbide Can Equipped with a Steam Coil to Serve as a Mixing Tank for "Penetrating" Oil

The oil is easy to compound, and together with the mixing equipment required, is quite inexpensive. In the illustration is shown the combination mixing tank and container used. The oil is thoroughly mixed in the tank by means of the steam coil, and drawn off as needed through a 3/8-inch globe valve. The tank can be made of heavy tin or light-weight boiler plate, but the most inexpensive and convenient method is to use a carbide can. It has a screw cover, which is very desirable, as it is practically air-tight and prevents evaporation. The coil is made of 3/8-inch copper pipe having a number of turns, preferably six, the ends being brazed to the can as indicated. A 3/8-inch iron nipple is also brazed to the can for the globe valve and spout. At the lower end of the coil on the outer side of the can is a 1/32-inch orifice which serves as a drain for the condensed steam during the mixing operation, but allows very little steam to escape.

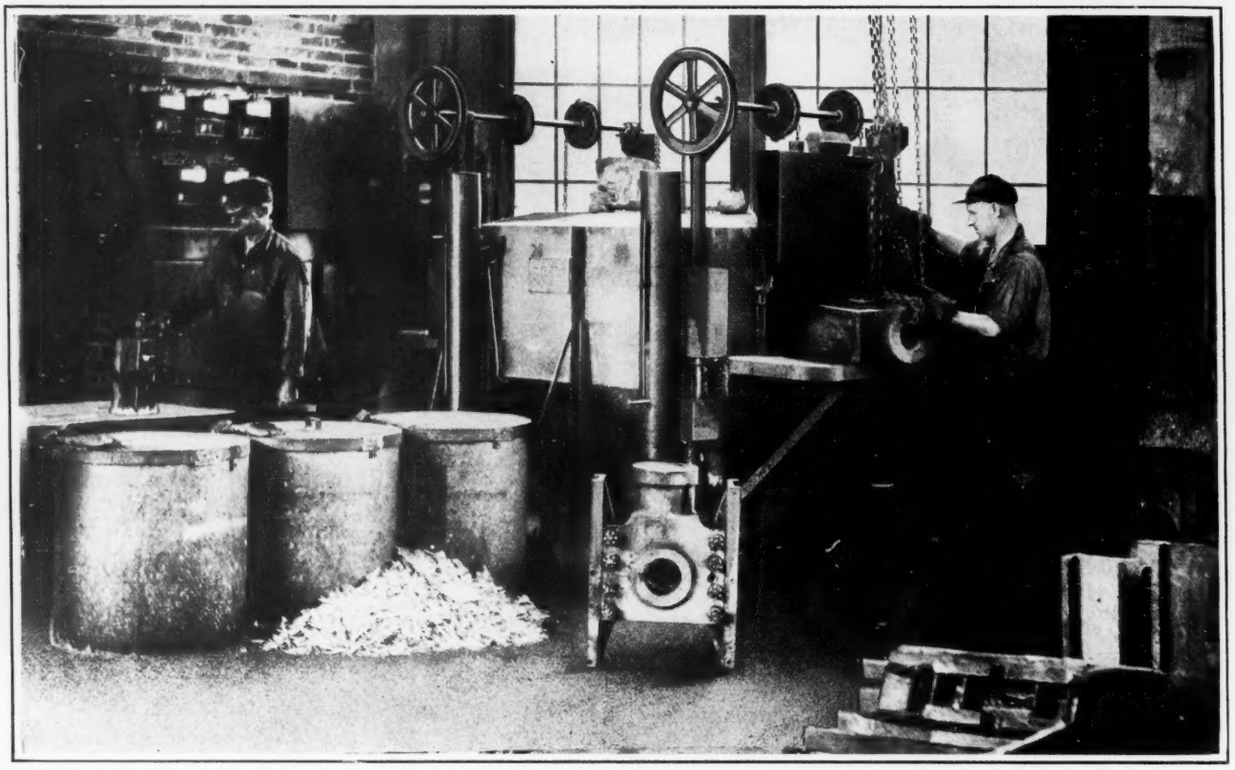
Two formulas for compounding the penetrating oil are given in the following:

Ingredients	No. 1 Oil	No. 2 Oil
Kerosene	25 per cent	30 per cent
Gasoline	15 per cent	20 per cent
Creosote	25 per cent	30 per cent
Heavy Cylinder Oil	35 per cent	20 per cent
Powdered Graphite	1 pound per 5 gallons	1/2 pound per 5 gallons

These two formulas have been found to give excellent results. If creosote is not obtainable, coal tar can be substituted, but creosote is preferable. Used oil from automobile crankcases can be substituted for heavy cylinder oil with excellent re-

sults. The penetration of oil No. 2 is surprisingly rapid, while oil No. 1 is slightly slower, but is better adapted for holding the graphite in suspension. The graphite is desirable, as it is deposited along the threads and considerably assists the lubricating qualities of the oil.

The correct proportions are placed in the mixing tank and the lid securely fastened. Steam is passed through the coil for about an hour. At the end of this time, the ingredients are thoroughly mixed. The mixture is then allowed to cool and is put in a convenient place to be drawn off when needed. It is a good practice to have a wooden paddle placed inside the can with which to stir the mixture just before drawing off a supply. This will circulate the graphite throughout the mixture.



A Babbitting Department in which Automatically Controlled Electric Equipment Insures Constant Temperatures

Modern Equipment in a Railroad Babbitting Shop

An electric furnace and electric melting pots, with automatic controls, have recently been installed in the babbitting department of the Canadian National Railway Shops at Stratford, Ontario. This equipment insures the maintenance of proper furnace temperatures and gives the department an unusually clean appearance.

Locomotive cross-heads sent to this department for rebabbitting are first placed in the right-hand end of the box furnace seen in the background of the illustration. Truck brasses are placed in the same furnace from the opposite end. The temperature of this furnace is maintained at approximately 850 degrees F., so as to melt off all the old babbitt on the parts. The melted babbitt flows from the furnace floor down through a chute and into a receptacle. It is later recast.

When all the old babbitt has been melted, the cross-heads and driving-boxes are removed from the box furnace. Jigs are attached to them, after which melted babbitt taken from the electrically heated pots is poured between the parts and the jigs. When the new babbitt has solidified, the jigs are removed from the parts.

Two of the three melting pots are generally in use, the third pot being kept for special jobs. The babbitt baths are held at a temperature of about 1050 degrees F. Electric furnaces are also used in other departments of the shops for heat-treating different parts, such as leaf springs. O. H.

* * *

In view of the present discussion of unemployment insurance, it may be interesting to note that employes in Austria, according to *Commerce Reports*, are entitled to receive notice of discharge at least six weeks in advance. This period is increased in proportion to the number of years of service. If such notice is not given, the employe may collect the wage he would have received during this period. Employes who have given three years or more of service are granted a dismissal wage of from two to twelve months.

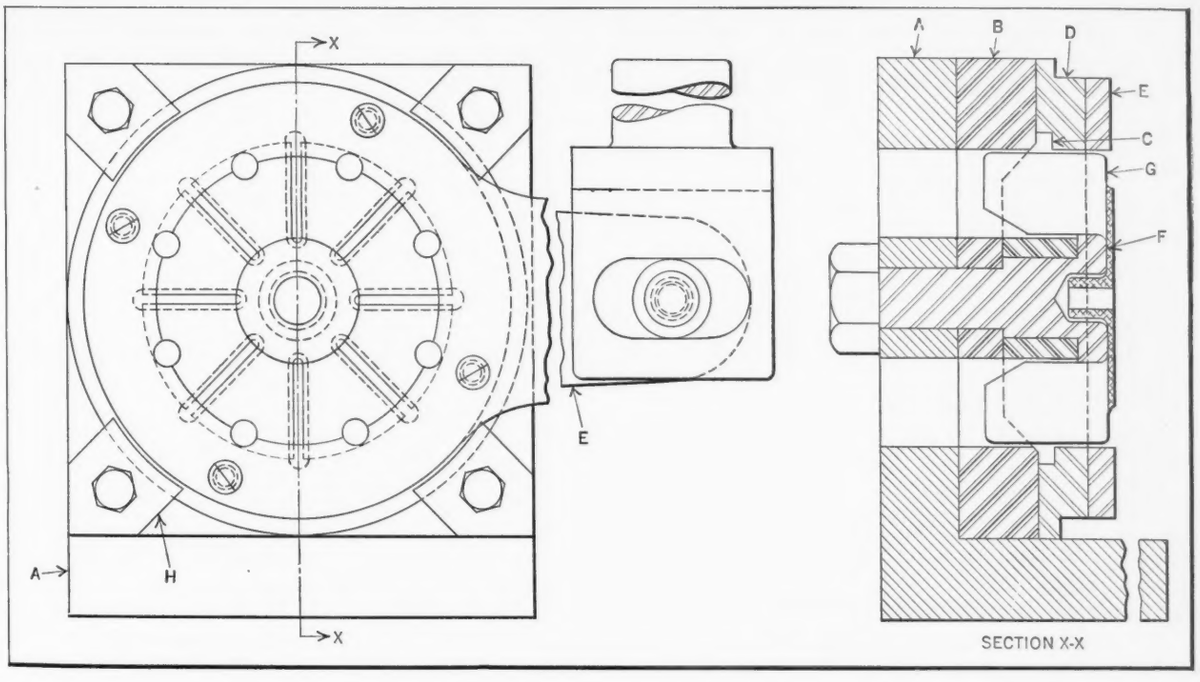
Die for Cutting Down All the Blades in a Fan Simultaneously

By EUGENE L. SOLTNER, Philadelphia, Pa.

In one plant, two different sizes of heater fans for automobiles are made from die-castings. The required production did not justify the expense of a die-casting die for each size, so it was decided to cut the fans down to make the smaller size. Incidentally, similar fans are made of steel stampings, and although they have fewer blades, the same method is used. The die used for cutting down the die-castings is shown in the illustration. The same type of die is suitable for fans stamped from steel. The fan to be cut down is indicated at *G*. An inclined press is used for the operation to facilitate the ejection of the scrap.

The die consists of angle-plate *A*, shearing members *B* and *C*, plug *F* for centering the fan, and the arm *E*. The right-hand end of arm *E* is connected to a plug secured to the press ram, and the other end is fastened to the retaining collar *D*, which is held in position by the gibs *H*. Member *C* is a running fit on plug *F*, but is fastened to collar *D* by eight pins, which also pass through lever *E*.

With this arrangement, member *C* turns with arm *E* and is given a partial revolution for each stroke of the press ram. Eight slots are cut in the die members *B* and *C* to receive the fan blades, the slots in member *C* being just large enough to allow



Die for Reducing the Size of a Heater Fan by Shearing All Blades During One Stroke of the Press

the blades to be inserted easily. The slots in member *B*, however, are about three times the width of those in member *C*, to provide ample clearance for the ejection of the scrap. This extra clearance introduces a shearing effect and reduces the tool shock.

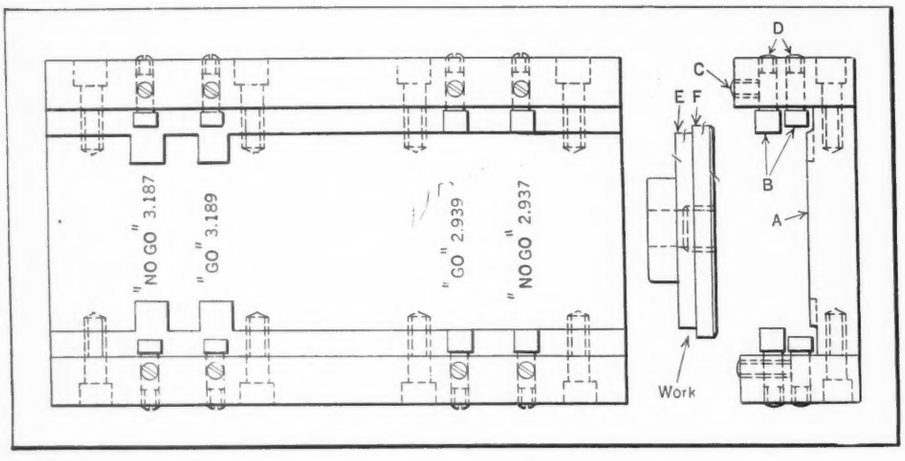
In operation, the ram of the press is raised to the top of its stroke, so that the slots in members *B* and *C* are in alignment. The blades of the fan are inserted in the slots with the hub of the fan against the head of stud *F*. Then the press is tripped and arm *E* is carried downward. The rotary movement thus imparted to member *C* carries the blades past the cutting edges of member *B*, causing the ends of the blades to be sheared off.

Adjustable Limit Gage for Production Work

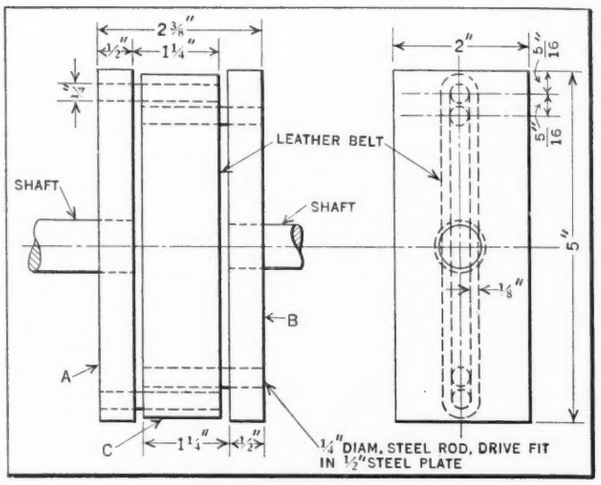
By H. S. TAYLOR, Cleveland, Ohio

The accompanying illustration shows an adjustable gage that has proved to be very fast and efficient for the inspection of machine parts of different sizes and shapes. The inspector simply drops the work in the center of the gage, and by sliding it to the left on surface *A*, brings it into position for gaging with one set of limit gages. When the work is slid to the right, it is gaged in a similar manner with another set of limit gages. This arrangement provides for gaging the diameters of the two surfaces *E* and *F*.

The gage pins *B* are made from tool steel and are hardened. They are held in place by screws *C* and adjusted by screws *D*. The contact surfaces of this gage can be ground on a surface grinder with the pins in place. Gages of this kind can be used to the best advantage where there is a finished face that can be used for locating purposes. The heights of shoulders can also be gaged in some cases, thus reducing the number of separate inspection operations. Dial gages can be mounted at the ends or sides of the gage body for gaging heights.



Gage with Two Sets of Adjustable Gage Pins for Inspecting Two Cylindrical Surfaces on One Piece



Flexible Coupling that Absorbs Shock and Permits Driving and Driven Members to be Connected Quickly

Shock-Absorbing Flexible Coupling

By W. E. STEWART, Sewaren, N. J.

The coupling shown in the accompanying illustration is used for testing small motors and generators. Simplicity of construction, adaptability, and elimination of the necessity for precise alignment of the two shafts are the principal features of this coupling. The dimensions given are for a coupling capable of transmitting 2 horsepower at 1000 revolutions per minute. The coupling consists of two steel plates *A* and *B*, each drilled to fit one of the two shafts to be coupled, and two steel pins fitted in each of the plates, as shown.

A heavy leather belt *C* is stretched tightly over the two outer pins, and the second plate is so placed that its pins are located inside the belt. The plates are fastened to their respective shafts by means of set-screws or keys. When one shaft revolves, the leather belt is brought to bear against the pins in the plate attached to the driven shaft, thus transmitting motion to the latter shaft. The leather, in tending to stretch, absorbs practically all shock.

This coupling is particularly adapted for use in testing quantities of small equipment which must be set up and put into operation quickly. Since there is no actual mechanical connection, except when power is applied, it is only necessary to remove the device tested and put another in its place. The arrangement of the belt also makes it unnecessary to have the two shafts in exact alignment. These two features are a great aid in speeding up equipment-testing work.

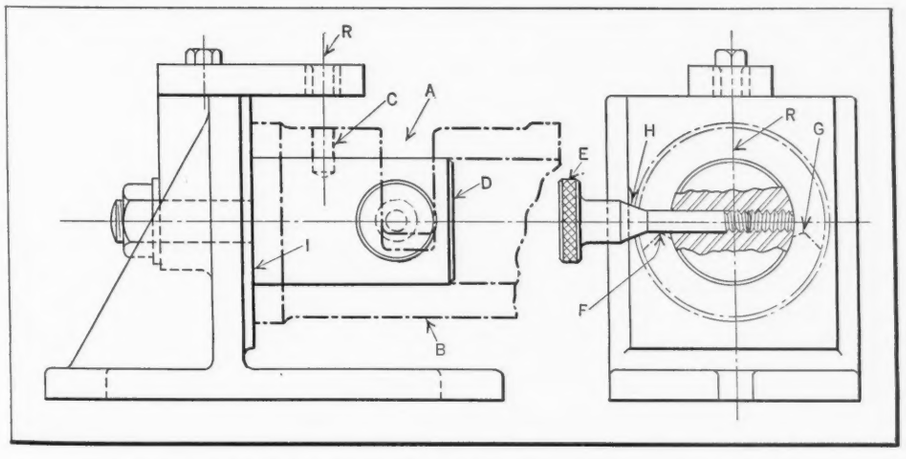
Jig for Drilling Radial Hole in Bushing

By CHARLES C. TOMNEY, Chief Tool Designer
Brunswick-Kroeschell Co., New Brunswick, N. J.

The cast-iron bushing shown by the heavy dot-and-dash lines at *B* in the accompanying illustration is used in the outboard bearing of a compressor. About four hundred of these bushings are required per year. The bearing is lubricated by the oil-ring system and the bushing must be centered so that the slot *A* will be on the upper side of the bearing to avoid interference with the oil-ring. In order to hold the bushing in this position, a hole is drilled at *C* to receive the turned end of a special screw in the bearing housing. The bushing is about 7 1/2 inches long and has an outside diameter of 4 3/4 inches. The hole *C* is 17/32 inch in diameter, and must be located 1 3/4 inches from one end and on the vertical center line *R*.

Slot *A* is cast in the bushing and is left unfinished except for the surfaces at *F* and *G*, which are smoothed off with a file. Hole *C* is drilled after the bushing is bored, reamed, turned, and faced. The reamed hole in the bushing is a slip fit on the steel plug *D* of the drill jig. The hardened steel screw *E* locates the surfaces *F* and *G* of slot *A* in the proper positions for drilling the radial hole *C*. The tapered surface *H* on screw *E* serves to clamp the bushing against the surface *I* of the jig. Thus the bushing is clamped in position for drilling by simply inserting the screw *E* and giving it about two turns in the threaded hole in plug *D*.

When screw *E* is being tightened, the bushing is held in such a manner that the surface at *F* is in contact with the screw. It is important that the screw *E* be inserted from the left-hand side as shown, because a right-hand thread is used. When this is done, the clockwise rotation of the tapered portion of the screw tends to revolve the bushing and keep the point *F* in contact with the body of the screw. This bushing has been found much more convenient than a type previously employed, which was equipped with a separate stop-pin and clamp.



Drill Jig with Knurled-head Screw that Serves to Locate and Clamp the Work in Place

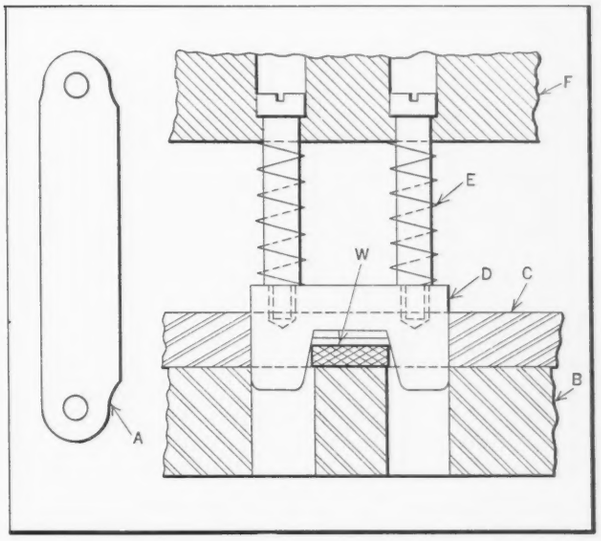


Fig. 1. Self-adjusting Centering Guide for Heavy and Narrow Stock

Self-Adjusting Guides for Strip Stock

The large number of articles now being manufactured from strip stock and flat wire by the "cut-off" process has created a demand for efficient equalizing stock guides that will center the stock properly and prevent the product from having the appearance shown at *A*, Fig. 1. The cross-section view shows a common form of equalizer which may be modified to suit conditions, the basic principle remaining the same.

In this view, the stock is shown at *W*, the die at *B*, and the stripper plate at *C*. The hardened-steel block *D* of inverted V-shape is slidably attached to the punch-holder or pad *F* by the two shoulder screws shown, and is normally held down by the springs *E*. This type of equalizer is usually satisfactory for stiff, heavy stock, but will not work well with material that is thin, soft, or very wide.

A type of equalizer designed on the principle of the parallel rule is shown in Fig. 2. The plan view shows the under side of the stripper plate in which the equalizing members are mounted. If carefully constructed, this device will handle a great variety of gages and widths quite satisfactorily when the stock is fed by hand.

In Fig. 3 is shown a modification of the type shown in Fig. 2 which has a number of improvements. One improvement is an adjustable, roller-bearing equalizing guide, which was designed for use with a roll feed. This equipment is used in

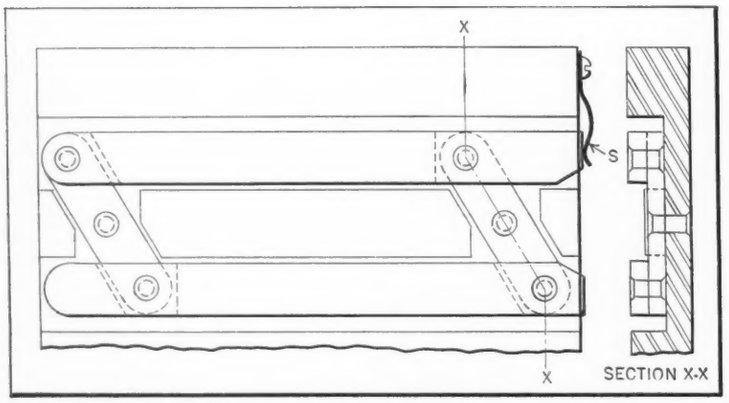


Fig. 2. Self-adjusting Guide Designed on Parallel Rule Principle

working up about forty miles of flat wire per year into parts having perforations that are required to be held central within 0.003 inch.

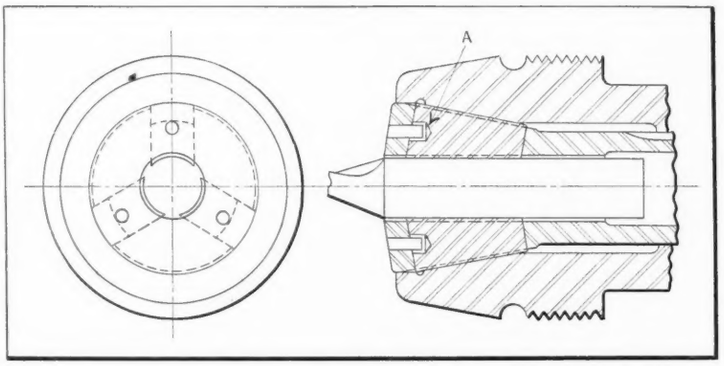
This design differs from that shown in Fig. 2 in that the wearing action of the stock is taken care of by the four rollers *R*. The equalizing members are mounted on separate adjustable slides, and a coil spring that can be adjusted for tension is provided in place of the flat spring shown at *S* in Fig. 2. The design shown in Fig. 2 was tried out on the roll feed job mentioned, but required truing up every few days on account of the wear on the equalizing members, while the roller-bearing device was used an entire year without repairs. Of the three types of self-centering guides illustrated, the one shown in Fig. 1 is probably the simplest to construct, and hence would ordinarily be selected in cases where the stock is heavy enough to be centered by the wedging action of block *D*. S. B.

Collet for Over- or Under-Size Cutter Shanks

By F. A. FIRNHABER, Waynesboro, Pa.

In cutting accurate slots in machine or tool parts, the design of the cutter collet is very important, if the width of the slot is to be equal to the diameter of the cutter. When a cutter has an over-size or under-size shank, and is held in an ordinary collet, the collet jaws bear on the cutter shank at one end only. In either case, this one-line bearing leaves the cutter free to run out or wobble while cutting, resulting in inaccurate slots.

In the illustration is shown a collet that overcomes the difficulty mentioned. The hole in the spindle nose is ground to a 10-degree taper with the center line, and the hardened and ground collet inserted in it. The collet bore is a few thousandths inch larger than the cutter shank diameter. Three slots for inserts are equally spaced around the collet, as shown in the end view. They are milled at right angles to the 10-degree taper. The ends of the inserts are half round.



Collet with Sliding Inserts that Adjust Themselves to Variations in Cutter-shank Diameters

The soft inserts are fitted to the slots with a good push fit, and bored in place in a dummy spindle, allowance being made for grinding. Holes *A* for retaining pins are drilled from holes previously drilled in the collet. These pins keep the inserts in place when the collet is not in use. The inserts and slots are now stamped Nos. 1, 2, and 3, after which the inserts are removed from the collet and

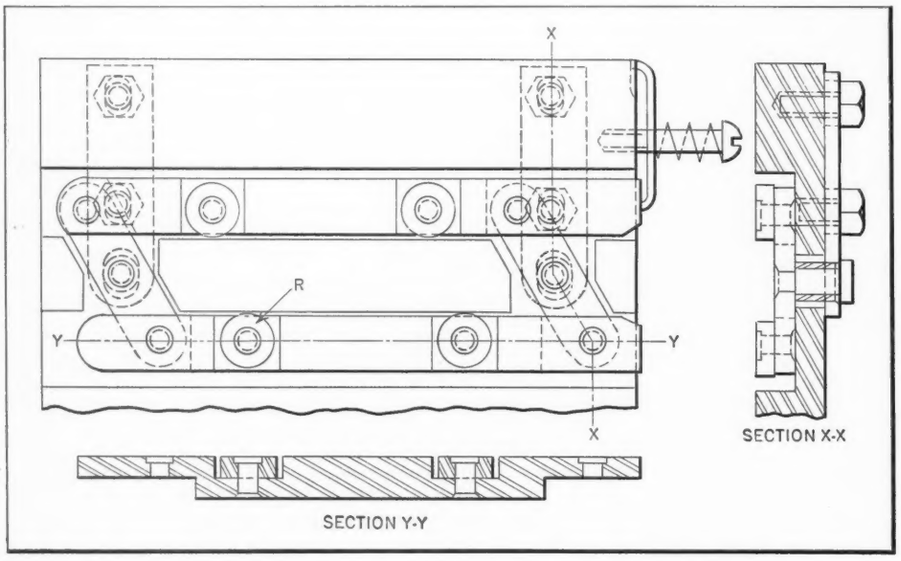


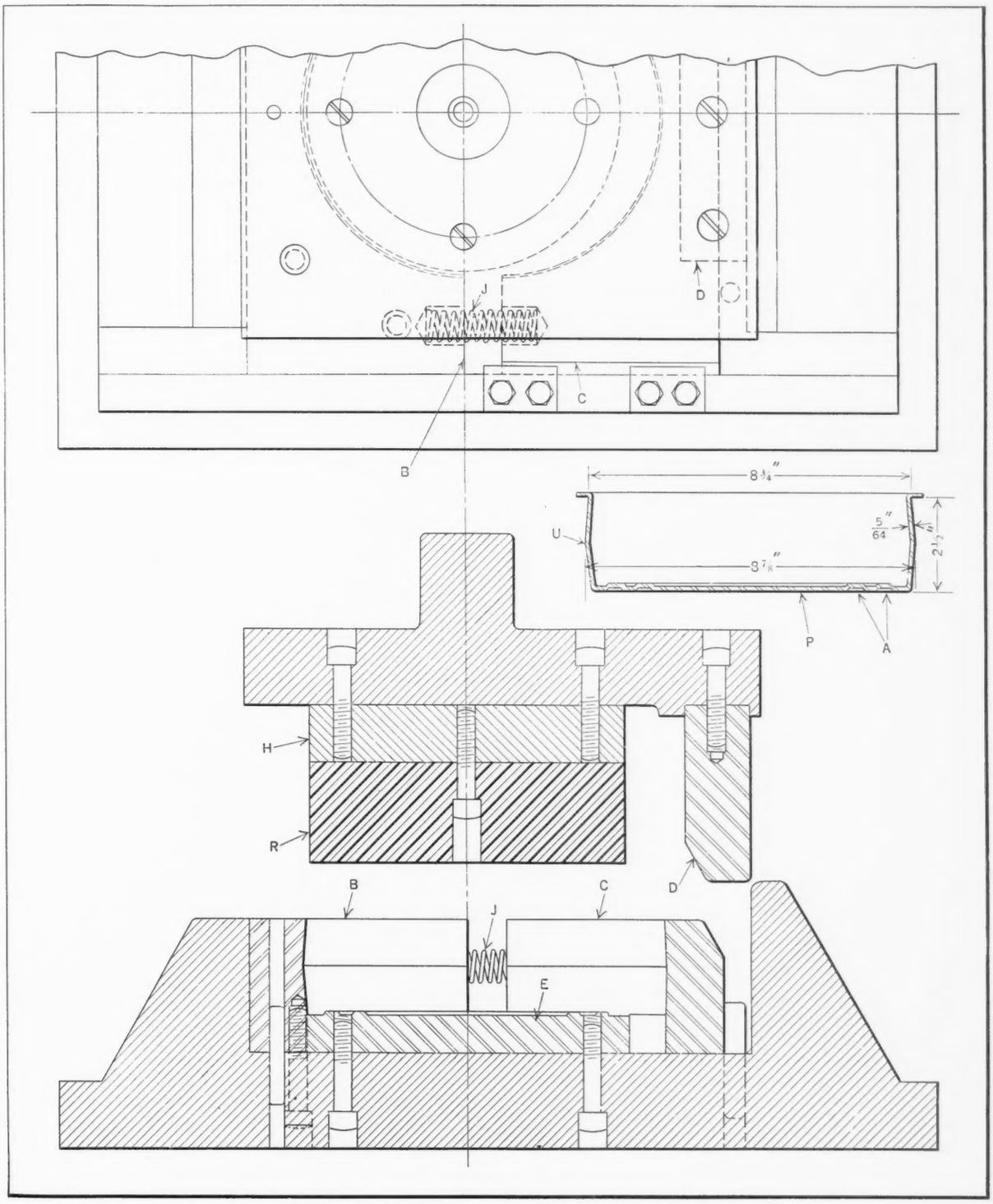
Fig. 3. Guide Similar to One Shown in Fig. 2, but with Roller Guides

hardened. They are then inserted again into the collet by a sweating process, and are ground to accurate size inside and outside. The inserts are now removed again, lapped to a snug sliding fit, and assembled, after which the retaining pins are driven into place. With this construction, the entire length of the tapered surfaces of the inserts comes in contact with the spindle, as do the clamping surfaces for the cutter shanks.

Bulging Die for Crowning Pressed-Steel Pulley

By GEORGE L. PYRITZ, Indianapolis, Ind.

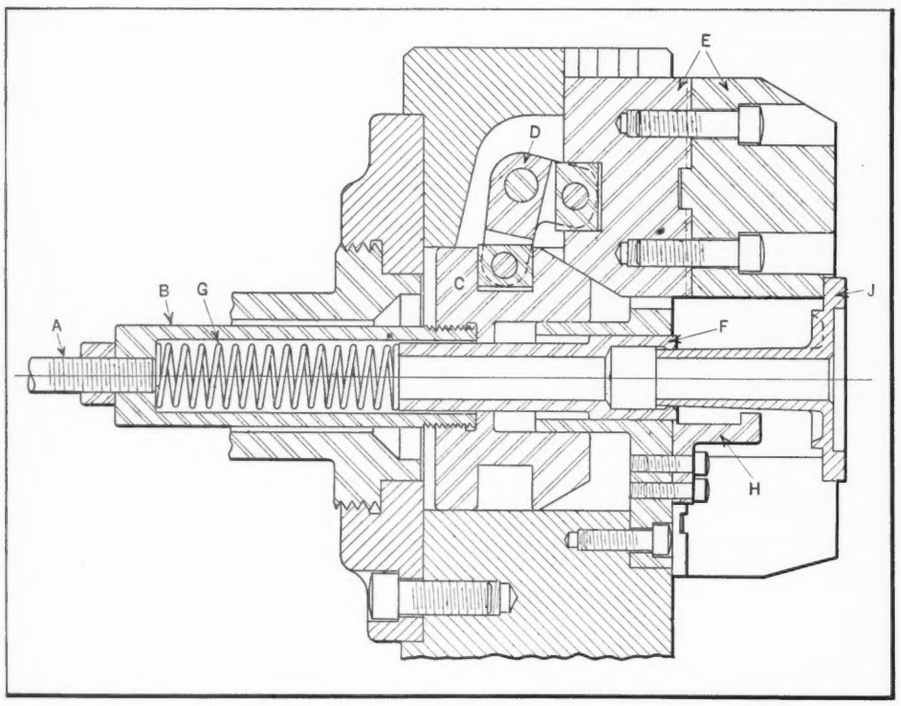
The die shown in the accompanying illustration is part of the equipment recently designed by the writer for producing pressed-steel pulleys like the one shown at *P*. The first operation consists of blanking and drawing the work to a diameter of



Rubber Bulging Die for Producing Crown on Sheet-steel Pulley

8 3/4 inches by 2 11/16 inches high with a "large-radius" flange. Following this, the work is placed in another die, where the corner of the flange is squared up, the work set to the correct height, and the ribs embossed at *A*.

After this has been accomplished, the work is placed in the bulging die shown in the illustration, the blocks *B* and *C* being separated by the two springs *J*. As the punch descends the cam block *D* strikes the angular edge of the die-block *C*, causing it to close upon the work. The rubber bulging pad *R* then enters the pulley, strikes the bottom of the work, and is squeezed outward, causing the pulley to expand and fill the inside of the die, which is shaped to produce the 1/16-inch crown indicated at *U*. As the punch ascends, the rubber contracts and passes out of the pulley freely. The die is opened and the crowned pulley is lifted out.



Air-operated Turret Lathe Chuck Designed to Insure Accuracy in Machining Flanged Bearings

In making this die, the die-blocks *B* and *C* were first squared up and then fastened together while being bored to the required size. They were then casehardened, and although used for some long runs, they have not shown any indication of breaking down. The plate *E* is casehardened steel, and is machined on its face to fit the embossed ribs *A* of the pulley in order to prevent them from being flattened out by the bulging operation. The cast-iron punch member *H* to which the rubber pad is secured is turned to a diameter slightly less than the inside diameter of the work.

The advantages of the rubber bulging die over an expanding steel die are lower initial cost and lower upkeep cost. It was found that comparatively little power was required to operate this die and that the bulged pulley conformed exactly to the shape of the die cavity without having any tendency to spring back.

Air-Operated Chuck that Centralizes Work at Both Ends

Large quantities of bearings such as shown at *J* in the illustration are machined successfully in a turret lathe through the use of an air-operated chuck that holds the bearings solidly at both ends. The operation consists of boring and reaming the hole and facing and counterboring the flanged end. Specifications call for a smooth round hole, concentric with the outside diameter to close limits. The bearings are made in different lengths, ranging from 2 1/2 to 5 inches. A multiple tool-head takes the various cuts simultaneously.

In designing the chuck for this operation, the problem was to provide a means of holding the casting tightly without distortion. Obviously, the place to grip the casting was on the large-diameter flange, and so the three-jaw air chuck shown was designed on this basis. Provision for centralizing the opposite end of the work was made through the use of the hollow support *F*. The casting becomes tight in this support about 1/4 or 3/8 inch from the end, a draft being provided which amounts to about 1/16 inch in a length of 3 1/2 inches. The work is located longitudinally by a shoulder on the chuck jaws.

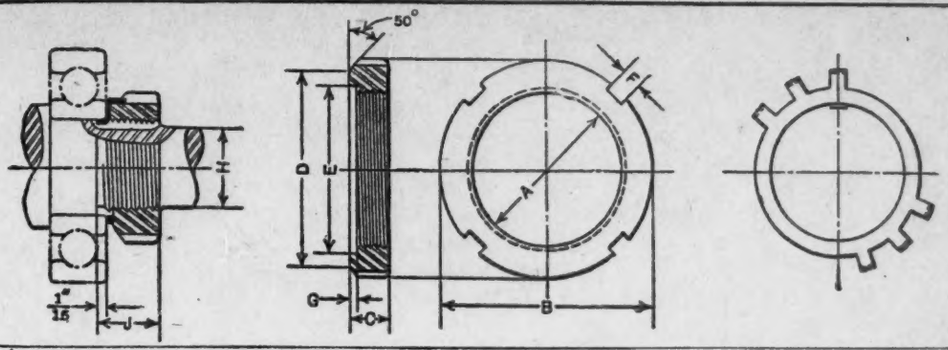
The chucking time for this operation amounts to less than one second. With one hand, the operator places a casting in the chuck and pushes it against the shoulder of the jaws, while with the other hand he operates the air valve to close the chuck jaws. As the piston in the air cylinder operates, it pulls draw-bar *A*, together with spring housing *B* and member *C*, toward the left, thus swinging the three levers *D* on their pivots. This closes the chuck jaws *E* firmly on the flange of the work.

Spring *G* pushes end support *F* forward when the chuck jaws are released, and thus ejects the casting. This travel of the end support is limited by stop *H*, which is attached to the face of the chuck. End support *F* was made of low-carbon steel and casehardened. It is a slip fit in the chuck bore.

G. L. P.

MACHINERY'S DATA SHEETS 229 and 230

LOCK-NUTS AND WASHERS FOR MOUNTING BALL BEARINGS ON SHAFTS

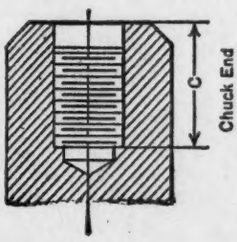


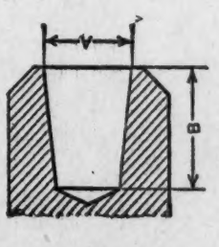
Lock-nut No.	Bearing Bore	Lock-Nut*								Shaft					
		A	Pitch Diameter		B	C	D	E	F	G	H	Pitch Diameter		J	Keyway	Keyway
			Maximum	Minimum							Maximum	Maximum	Minimum		Width	Depth
0	0.3937	0.3541	0.3747	0.3717	3/4	7/32	1/2	13/32	1/8	1/32	5/16	0.3707	0.3677	5/16	1/8	1/16
1	0.4724	0.4321	0.4529	0.4497	7/8	5/16	23/32	1/2	1/8	1/32	13/32	0.4487	0.4457	13/32	1/8	1/16
2	0.5906	0.5491	0.5697	0.5667	1	5/16	27/32	5/8	1/8	1/32	1/2	0.5657	0.5627	13/32	1/8	5/64
3	0.6693	0.6271	0.6477	0.6447	1 1/8	11/32	29/32	23/32	1/8	3/64	9/16	0.6437	0.6407	7/16	1/8	5/64
4	0.7874	0.7441	0.7647	0.7617	1 3/8	3/8	1 1/8	27/32	3/16	1/16	23/32	0.7607	0.7577	15/32	3/16	5/64
5	0.9843	0.9321	0.9527	0.9497	1 9/16	13/32	1 9/32	1	3/16	1/16	7/8	0.9487	0.9457	17/32	3/16	3/32
6	1.1811	1.1073	1.1399	1.1369	1 3/4	13/32	1 1/2	1 7/32	3/16	1/16	1 1/16	1.1359	1.1329	17/32	3/16	3/32
7	1.3780	1.3103	1.3429	1.3393	2 1/16	7/16	1 13/16	1 7/16	3/16	1/16	1 1/4	1.3389	1.3359	9/16	3/16	3/32
8	1.5748	1.4973	1.5299	1.5269	2 1/4	7/16	2	1 5/8	1/4	1/16	1 15/32	1.5259	1.5229	9/16	5/16	3/32
9	1.7717	1.7013	1.7339	1.7309	2 17/32	7/16	2 9/32	1 13/16	1/4	1/16	1 11/16	1.7299	1.7269	9/16	5/16	3/32
10	1.9685	1.9033	1.9359	1.9329	2 11/16	1/2	2 7/16	2	1/4	1/16	1 7/8	1.9319	1.9289	5/8	5/16	3/32
11	2.1654	2.0913	2.1239	2.1209	2 31/32	1/2	2 21/32	2 3/16	1/4	3/32	2 1/16	2.1199	2.1169	5/8	5/16	3/32
12	2.3622	2.2943	2.3269	2.3239	3 5/32	17/32	2 27/32	2 13/32	1/4	3/32	2 1/4	2.3229	2.3199	21/32	5/16	3/32
13	2.5591	2.4823	2.5149	2.5119	3 3/8	9/16	3 1/16	2 19/32	1/4	3/32	2 7/16	2.5109	2.5079	11/16	5/16	3/32
14	2.7559	2.6853	2.7179	2.7149	3 5/8	9/16	3 5/16	2 13/16	1/4	3/32	2 5/8	2.7139	2.7109	11/16	5/16	3/32

*Lock-nuts numbered from 0 to 5 inclusive have thirty-two threads per inch, and those numbered from 6 to 14 inclusive have eighteen threads per inch.

MACHINERY'S Data Sheet No. 229, New Series, July, 1932 — **SAE Recommended Practice**

JACOBS TAPERS AND THREADS FOR DRILL CHUCKS





Taper No. or Letter (Jacobs)	Tapered Holes		Dimensions of Spindle Holes in Chucks	Threaded Holes		
	Equivalent Taper, Inch per Foot	Diameter A	Depth B	Outside Diameter of Thread	Threads per Inch	Depth of Thread C
0	0.5976	0.2506	1/2	3/8	24	9/16
1	0.9238	0.3846	3/4			
2	0.9780	0.5497	13/16	1/2	20	9/16
3	0.6372	0.8114	1 9/32			
4	0.6264	1.1235	1 3/4	5/8	16	11/16
5	0.6228	1.4127	1 15/16			
6	0.6216	0.6761	1 1/16	45/64	16	11/16
D	0.9575	0.5492	13/16	3/4	16	11/16
E	0.6240	0.7886	7/8			

Drill chucks are ordinarily furnished to fit tapered or threaded spindles. Taper and thread specifications in accordance with the Jacobs numbering system have been generally adopted by makers of chucks and also by the makers of the machines and portable tools that the chucks are intended to fit. The dimensions of Jacobs tapers and threads in the spindle holes of chucks are given in the table.

Data Sheets to follow will show the spindle specifications of various makes of portable drills, the trade name or designation being given opposite the name of the company. In ordering replacement chucks for these tools, it is necessary to specify the capacity of the chuck and the taper or thread specifications of the spindle hole. All the portable drills mentioned in these Data Sheets have spindle ends conforming with the dimensions of the holes given above.

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MACHINERY'S Data Sheet No. 230, New Series, July, 1932

Contributed by Jacobs Mfg. Co., Hartford, Conn.

Cutting off Bar Stock at the Rate of One Piece Per Second

By H. C. MEYERS

As many as 3600 pieces of bar stock per hour, or one piece per second, are cut with the equipment shown in the illustration. A standard power hacksaw is employed for this purpose, but the unusually high production is attributed to the use of special clamps for stacking the bars and an old lathe bed, with its carriage, for feeding the bars rapidly to the cutting position.

The bars have various cross-sections and range from 1/2 to 10 inches in length. The quantities for each size vary from 100 to 10,000 pieces. Formerly the bars were cut off by shearing; sawing in a milling machine by means of gang saws was also tried. These methods, however, proved unsatisfactory; the shearing process distorted the bars and the gang sawing operation was too slow. The present method has overcome these objections at little additional cost.

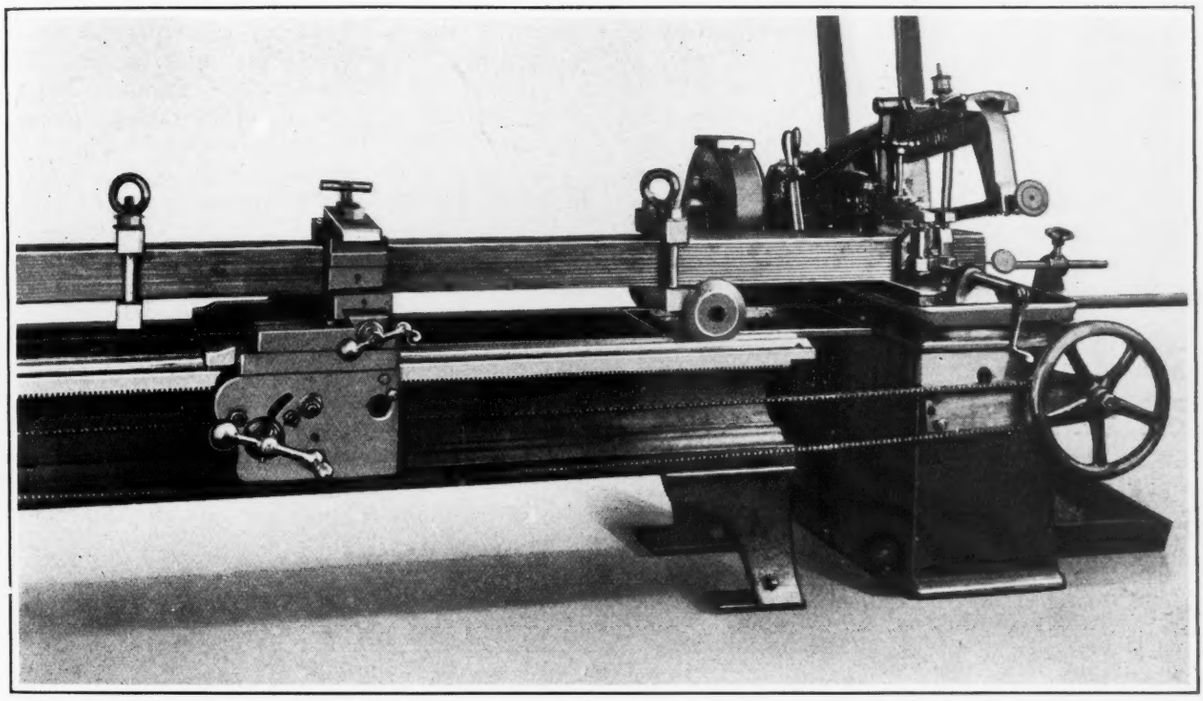
The lathe bed is bolted to the floor at the rear of the sawing machine. The cross-slide is equipped with a clamping device for securing the bars firmly to the carriage. Provision is made for feeding the bars to the saw by means of a sprocket chain fastened at one point to the carriage. This chain passes over an idler sprocket at the left-hand end of the lathe bed and over another sprocket wheel on the large handwheel mounted on the sawing machine. In order to use this arrangement, it was necessary to remove the rack pinion and lead-screw from the lathe. Then, by turning the large handwheel, the carriage is moved along the lathe bed, bringing the bars into the cutting position. Floating rollers are also provided for supporting the long bars where the greatest deflection occurs.

After securely clamping the bars in the manner shown, the handwheel is turned until the ends of the bars come into contact with a dial gage secured to the sawing machine base. When the gage registers zero, the vise is tightened and the cut is started. The movements required of the operator are few, owing to the centralized control.

* * *

The production of automobiles throughout the entire world amounted to only 3,042,000 in 1931, as compared with 4,125,000 in 1930, 6,275,000 in 1929, and 5,200,000 in 1928. Outside of the United States (where the total production of cars, trucks, and buses amounted to 2,390,000), the United Kingdom, France, and Germany were the leading producers. The output of the United Kingdom numbered 223,000, that of France 197,000, and that of Germany 65,500. Italy produced 31,500 cars and trucks, and Soviet Russia 23,400. Czechoslovakia also had a fair production—17,000. Other countries that produced automobiles in quantities varying from 1000 to 5000 were Austria, Belgium, Sweden, and Switzerland.

Complete statistical data on the world production and exports of automobiles for 1931 are available in the May 23 number of *Commerce Reports*, published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.



An Old Lathe Bed with Special Bar Clamps Provides Means for Obtaining High Production on a Power Hacksaw

Apparatus for Hardening Delicate Work

Equipment Permits Transferring Work from Furnace to Quenching Bath without Exposure to Air

By HUBERT R. SCHMIDT

A PRODUCT, such as the knitting machine latch needle shown in the upper view of Fig. 1, that is of small cross-section in proportion to its length is likely to be very sensitive to the heat-treatment it receives, and any irregularity in the hardening and tempering cycle generally results in distortion, loss of surface, carbon, and discoloration. The equipment illustrated in Figs. 1 and 2 has been found very satisfactory for hardening latch needles like the one shown, and is recommended for small slender work that must be hardened with a minimum amount of distortion and decarburization. With this equipment, the work does not come in contact with the air, when heated, except with the small amount that remains in the container after it is loaded. Also, the various heats enter the quenching bath at the same velocity, which tends to insure uniformity.

The outfit consists of a container *A*, a plate *B* on which the container is placed before being put in the furnace, and a cradle *C* which fits the top of the oil tank *D*, Fig. 2. The container *A* is made of 4-inch round stock, bored out to suit the work and turned with a flange on the outside which serves to keep it from tipping over. In Fig. 1, the container *A* is shown to a small scale, while the work is shown full size.

The plate *B* is made of 1/8- by 4-inch flat stock, 14 inches long. One end of this plate is bent up to permit it to be gripped easily with the tongs. In the other end of the plate is a hole *E*, about 1/4 inch larger in diameter than the bore in the work container. Both the container and plate are made of rustless steel or any neutral metal that does not absorb or give off carbon at hardening heats or flake or deteriorate on being alternately heated or cooled.

The cradle *C* is made of 1/8- by 1-inch angle-iron held together by 1/8- by 1-inch flat pieces fastened in place by rivets. It is made just wide enough to permit the plate *B* to slide freely. The ends of the angle-iron are bent up, as shown, to let the bottom of the cradle rest on top of the quenching oil. In operation, the oil tank is rigged up in front of the furnace, with the top of the tank in line with the floor of the furnace, as shown in Fig. 2. A sieve *F* and the sheet-metal cylinder *G* are placed in the tank *D* to facilitate removing the work.

In using the equipment, cradle *C* is placed in position on top of tank *D*, as shown in Fig. 2, care being taken to see that the oil level is just high enough to touch the bottom of the cradle. The container *A* is loaded with work and placed on the closed end of plate *C*. The plate is then placed in the furnace, a pair of tongs being used in the manner indicated.

When the work has reached the hardening temperature, the operator grips plate *B* with the tongs and, at one motion, draws it into the cradle over

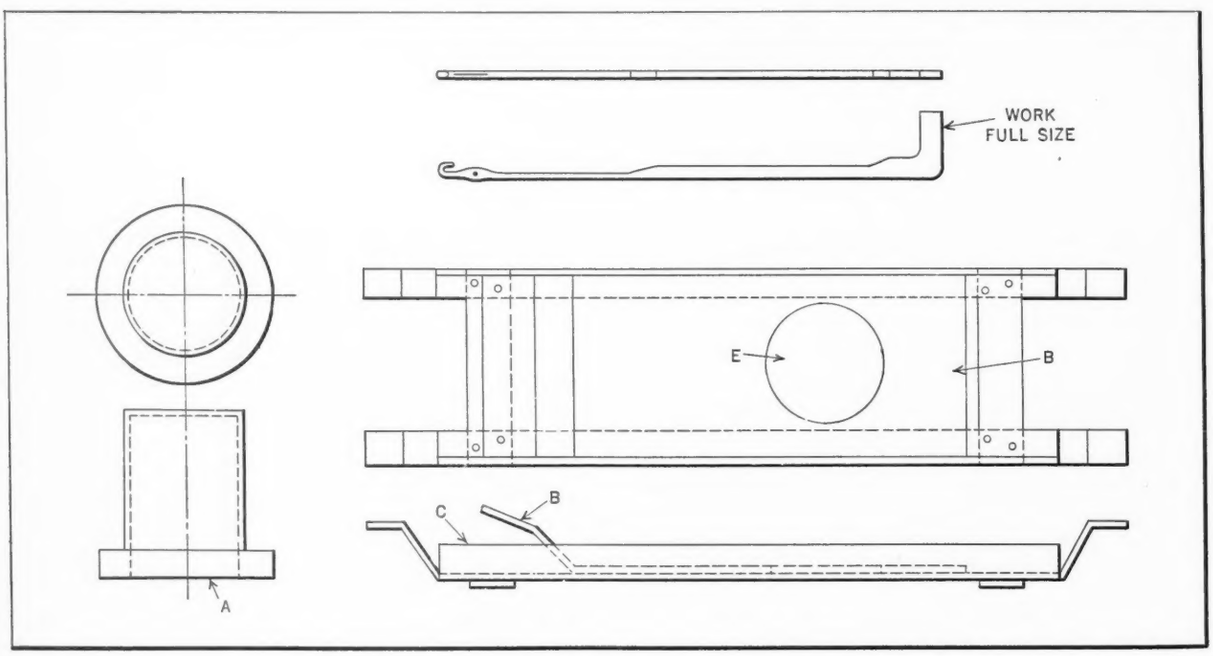


Fig. 1. Example of Slender Work and Special Equipment Used for Hardening

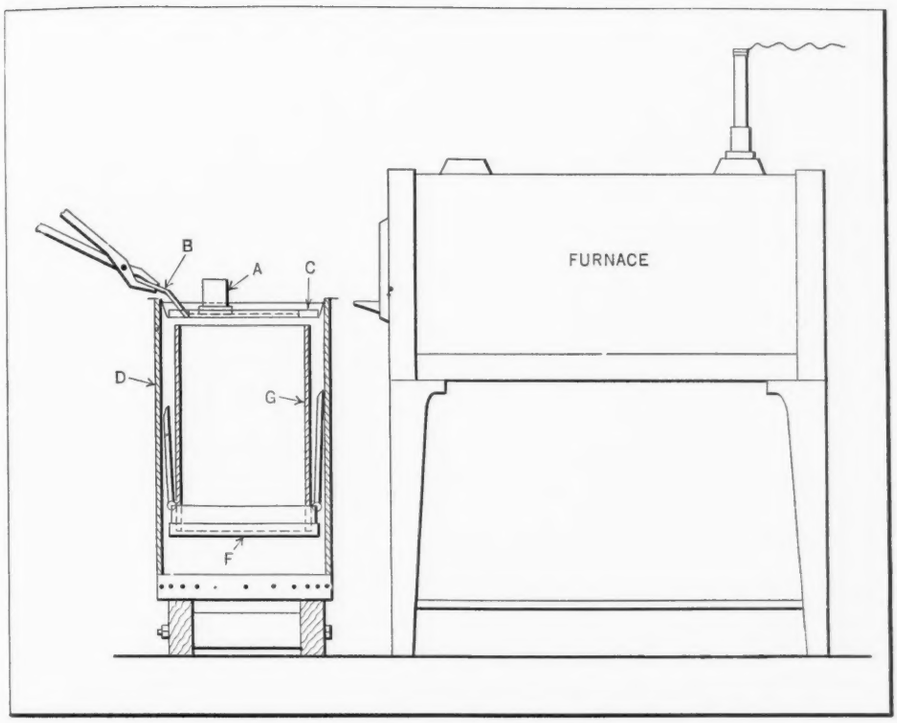


Fig. 2. Arrangement of Furnace and Quenching Tank for Hardening Delicate Work

the oil. Then, using an old file held in his free hand, he pushes the container over the hole in the plate so that the work falls into the quenching bath. The sides of the cradle are high enough to act as a guide for the container. If the surface of the oil is close to the cradle, the work will always come out bright, clean, free from scale or discoloration, and with practically no distortion.

* * *

Experiments with Alloy Cast Iron

A paper was read by F. W. Shipley, foundry metallurgist with the Caterpillar Tractor Co., Peoria, Ill., before a meeting of the Society of Automotive Engineers held in Boston, Mass., on the characteristics of alloy cast iron. This paper referred to a number of experiments that have been undertaken for the purpose of determining the characteristics of cast iron having different alloying elements.

The author reviewed the results of the experiments as follows: Nickel alone, added to any given base iron that is suitable for a particular casting, will not materially improve the casting except in machining qualities. In other words, either the silicon must be lowered to a point that would be dangerous and nickel added to offset the chilling effect of the low silicon, or chromium must be added and nickel introduced in an approximate ratio of three parts of nickel to one part of chromium to offset the difficulties experienced in machining if chromium alone were added. The latter method is the most practical for use in the average production foundry, owing to the possibilities of producing many different grades of iron from one base.

We must not lose sight of the fact, however, that whatever alloys are used, the base mixture must be of as high quality as it is possible to obtain, and further improvement made by additions of alloys. Alloys added to a poor or inferior grade of iron are only wasted.

Nickel-chromium alloy iron, when used for automotive cylinders, is superior to plain iron as regards hardness, strength, and microscopic structure. Nickel-chromium alloy irons are greatly superior, as far as heat-resistant properties are concerned, to ordinary irons. Irons alloyed with chromium produce a superior chill and afford a practical method for the production of special castings of this type.

* * *

Short Method of Triangle Calculation

By GEORGE W. AMRHEIN

A short method of finding one side of a right triangle when the hypotenuse and one side are known is described in the following. It saves the time required to square one of the sides and its theory is based on the algebraic axiom: "The product of the sum and the difference of two numbers is equal to the difference of their squares." That is, $(a + b)\ (a - b) = a^2 - b^2$. In a right-angled triangle, let a be the hypotenuse, and b and x the other sides. Assume that a equals 5.4375 and b, 3.3125. Then, $a + b = 8.7500$ and $a - b = 2.1250$. Further, $(a + b)\ (a - b) = 8.75 \times 2.125 = 18.59375$. Extracting the square root of 18.59375 gives 4.31205 for the side x.

This method is especially convenient when using logarithms, in which case we have log $(a + b) = 0.9420081$ and log $(a - b) = 0.3273589$. The sum of these logs equals 1.2693670. Dividing 1.2693670 by 2, to extract the square root, gives 0.6346835. The number corresponding to this logarithm equals 4.31205, which equals the required side x.

* * *

A fourteen-cylinder, two-row, radial, air-cooled motor was recently produced by the Pratt & Whitney Aircraft Co., under the supervision of the Navy Department, and installed in the Vought "Corsair" plane. It develops 625 horsepower.

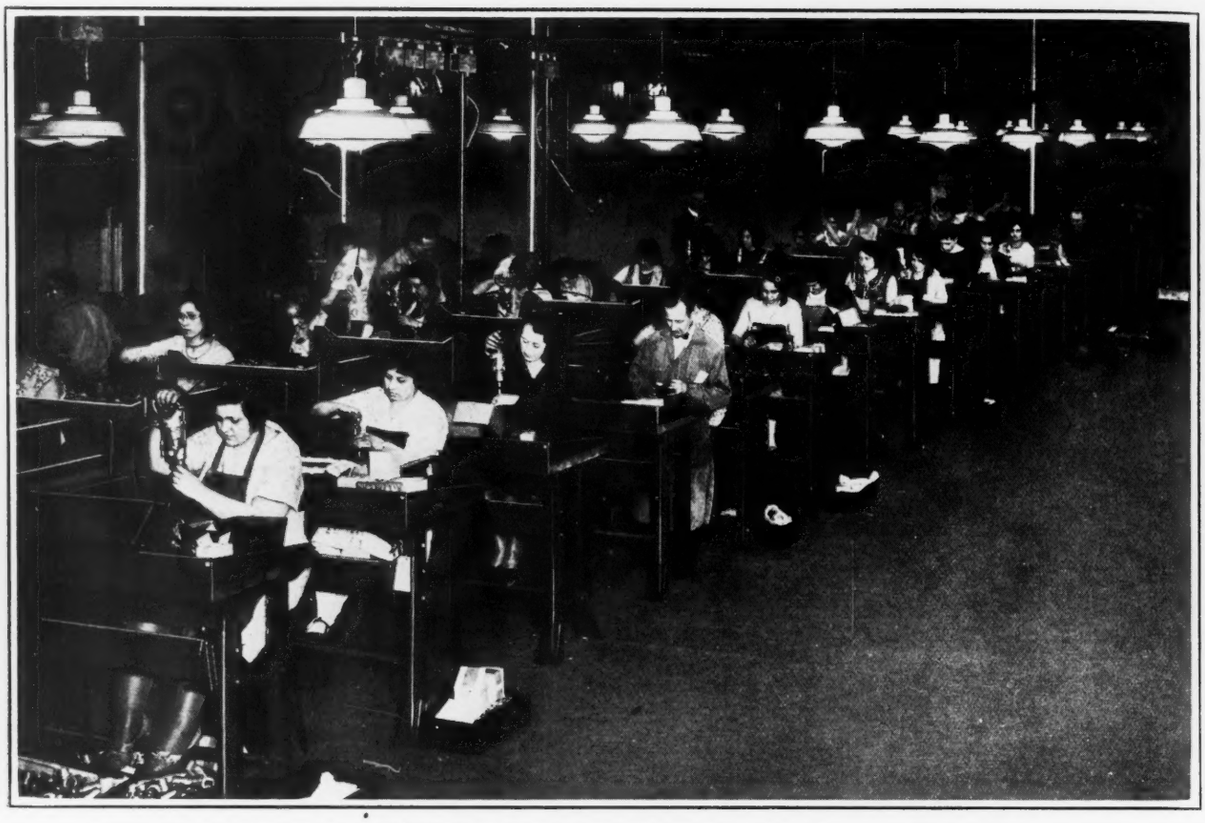


Fig. 1. By Placing Assembling Benches at Right Angles to the Conveyor, Floor Space has been Saved and Greater Output has been Obtained

Advantages Obtained by Seating Assemblers at Right Angles to Conveyor

IN a conveyor installation at the plant of the Bendix-Stromberg Carburetor Co., South Bend, Ind., used for assembling carburetors, the benches occupied by the assemblers are positioned at right angles to the conveyor. The carburetor units are automatically shunted to these benches from the conveyor belt.

This conveyor installation, which is shown in Fig. 1, consists of two belts 14 inches wide, driven by one motor. One belt serves the group of assemblers at the front, and the other the group at the rear. Two different types of carburetors are assembled by these groups.

The compactness of this arrangement has saved a great amount of floor space. Another important advantage is that the automatic delivery of the partly assembled carburetors to the benches relieves the assemblers from the necessity of watching the work in order to make sure that they do not miss any units. This feature saves a large amount of time and energy.

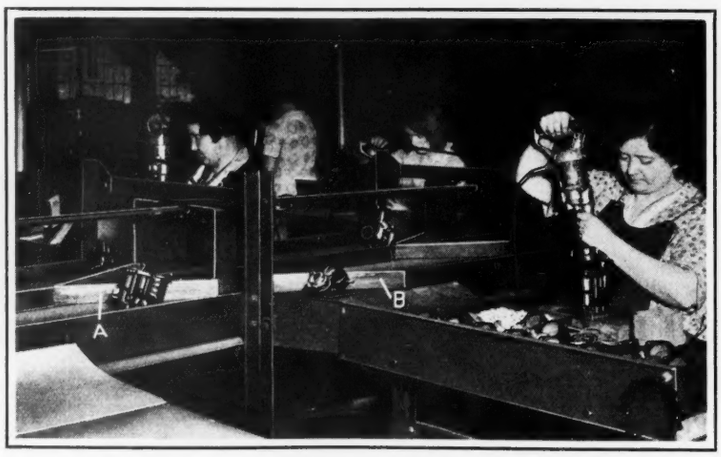


Fig. 2. Simple Flat Iron Bars Deflect the Different Carburetor Units to the Proper Assemblers' Benches

The automatic delivery of the partly assembled carburetors to the benches also provides an incentive for the assemblers to work fast, as they do not like to see the work pile up. The installation results in an output at least 15 per cent higher than is obtained when the assem-

blers sit at a long continuous bench and pass the work by hand to the successive assemblers. Electric sockets at each bench provide for attaching motor-driven screwdrivers and other portable tools.

Fig. 2 shows a close-up view of the arrangement for shunting the partly assembled carburetors to the different benches. Flat iron bars *A* and *B* are placed across the path of the conveyor at an angle that deflects the carburetor units to the benches. If any of the units are not required by an assembler, bar *A* is taken out adjacent to that particular assembler's bench. The preceding assembler places the parts in question near the inner side of the conveyor belt, and thus the parts pass by without being deflected.

At the beginning of the assembly line, some of the girls work on the carburetor bodies and others on the carburetor tops. Later on, these two units are assembled together. A number of the girls and men in the groups shown in Fig. 1 perform inspections between the different assembly steps. The assemblers work on a group bonus system.

* * *

Stainless Steel Tubing

Stainless steel is being used to an ever increasing extent for the manufacture of tubing. Such tubing meets the requirements of the chemical, oil refining, and other industries where piping is exposed to chemical action. The importance of stainless, corrosion- and heat-resisting piping is obvious when the longer life of apparatus, the reduced delays or shutdowns required for the replacement of tubular parts, and the higher operating temperatures permissible are considered. In addition, the stainless tubing has a surface finish and appearance that in many instances is a valuable factor. Thus, the combination of corrosion resistance, improved strength at high temperatures, and clean bright surfaces for various purposes has created an important place for stainless tubing in industry.

* * *

A Design Exhibition

An exhibition labeled "The Designer and Industry" opened June 20 at the Art Center Building, 65 E. 56th St., New York City, and will continue throughout July, August, and September. Objects designed for machine production with the exception of furniture, are eligible for exhibition. Additional information may be obtained from Alon Bement, director of the National Alliance of Art and Industry, 65 E. 56th St., New York City.

What is Denitriding?

The field for nitriding has been greatly broadened by the new processes developed for local or entire softening of the nitrided case. Little is generally known of the methods used for "denitriding," as this method of softening the nitrided case is called. Ordinary annealing is impractical for this purpose, as even relatively high annealing temperatures do not soften the case sufficiently for machining. H. H. Ashdown, metallurgist of the Westinghouse Electric & Mfg. Co., will explain in detail in August MACHINERY how denitriding is carried out, adding thereby some very important information to the subject of the treatment of steel.

The Labor Cost is Not the Whole Cost

Frequently, in designing special tooling equipment, the tool engineer is led astray by the possibility of reducing labor costs to very low levels. The design should not be based on labor costs alone. All the elements of cost must be considered. Recently, in a certain case, it was found economical to make a comparatively few pieces at a direct labor cost of $1.20 each, although it was perfectly feasible by the use of expensive tools to produce these pieces in large quantities at a labor cost of 2 cents each. However, with the small quantity required, the savings resulting from the low labor cost would have been offset by the cost of the tools. Overhead costs, tool costs, and all other items of similar character must be considered, as well as the direct labor cost. This seems elementary, but it apparently needs to be restated, because of the frequent violations of this rule. The labor cost is not the whole cost.

* * *

In an address before the Association of National Advertisers at Cincinnati, Charles R. Hook, president of the American Rolling Mill Co., stated that obsolete anti-trust legislation has been largely responsible for the long duration of adverse business conditions. In many respects, he declared, anti-trust legislation has actually been detrimental to the interests of consumers; it has encouraged waste and duplication in many instances, thereby increasing the cost to the ultimate buyer. There should be no opposition to such cooperation between competitors as would serve the purpose of stabilizing employment and reducing costs of manufacturing and distribution.

* * *

American Machinery and Tools Institute Elects Officers

The American Machinery and Tools Institute, 40 N. Wells St., Chicago, Ill., at its annual meeting held in Chicago, elected the following officers: President, W. R. Mau, Vanadium-Alloys Steel Co.; vice-president, A. H. Brown, International Harvester Co.; treasurer, Craig B. Hazelwood, First National Bank; secretary, George B. Tuthill.

* * *

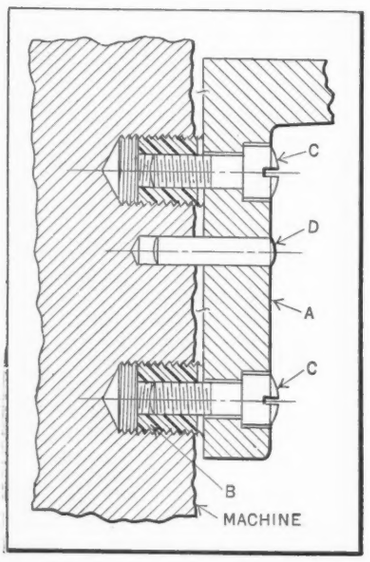
A recent investigation indicates that from 1922 to 1932 there was an increase of over 100 per cent in the motor horsepower of machine tools having identical size designations.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Attaching Auxiliary Devices to Machines Having Rough Surfaces

A finished surface on a machine frame is not always available for attaching a new device or special part. In cases of this kind, the simple method shown in the accompanying illustration can be employed. This method is inexpensive to apply and it provides a means of accurately locating and adjusting the attachment. The parts required for attaching the bracket *A* are the threaded bushings *B*, screws *C*, and the dowel-pins *D*. The bushings *B* are threaded on the inside to fit the screws *C*. A fine thread is cut on the outside of the bushings to provide close adjustment in the drilled and tapped holes in the rough machine frame. A slot is cut in the head of each bushing to facilitate insertion and adjustment.



Method of Attaching Bracket to Rough Cast-iron Surface

To attach a bracket such as shown at *A*, it is only necessary to drill and tap the holes in the machine frame so that they will align with the holes in the bracket. The number of bushings required depends on the size and design of the bracket or part to be attached to the machine. The screws *C* prevent the bushings from turning when they are tightened to hold the bracket in place. The dowel-holes can be transferred or drilled in the machine frame after the bracket is adjusted. The dowel-pins thus provide a means of permanently locating the bracket.

Richmond Hill, N. Y. HENRY W. BOEHLY

Made-to-Order Draftsmen's Curves

Ship-type curves, which can be quickly formed from thin sheet celluloid, may be used in place of a regular flexible curve for drawing long slightly curved lines. To form the ship curves, first tack down a sheet of celluloid on the drawing-board; then with a razor blade held between the fingers, cut a series of lines across the width of the sheet. Keep the fingers and wrist rigid and try only to follow the general outline of the curve required, making the cut with a free-arm swing. These curved lines should be about 1 1/4 inches apart.

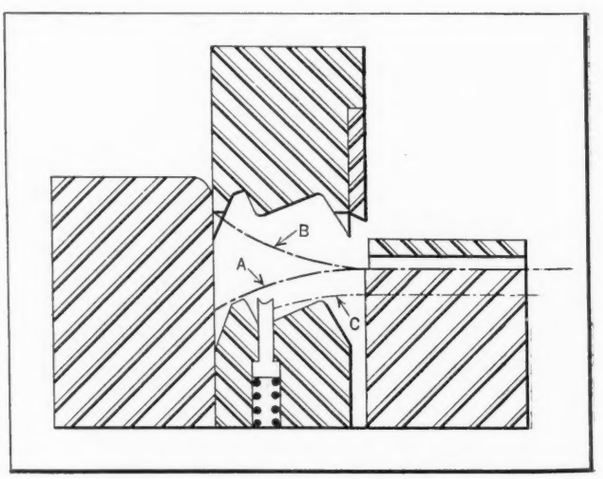
The blade will make only a light scratch or line on the surface of the celluloid. This is sufficient, however, to permit the thin sheet to be broken away exactly on the scribed lines, with smooth edges that will require no further finishing.

Cleveland, Ohio A. W. EIDMAN

Feeding Stock from Bottom of Coil Corrects Trouble

The pieces produced in the combination forming and cutting-off die shown in the illustration were being cut off too long, and the writer was called into the press room to remedy the trouble. The material was bronze, 0.010 inch thick by 3/64 inch wide, and was being fed from a coil mounted on a reel. The stock was being fed from the top side of the coil, and when passed through the stock guide, it took a downward course, as shown by the dash-and-dot line *A*. Naturally, the piece was too long when cut off under these conditions.

The operator was instructed to feed the material from the bottom side of the coil so that it would enter the die as shown at *B*. Of course, the amount fed into the die was too much, but when the punch descended, it straightened out the material, forcing the excess length back through the stock guide opening, thus eliminating the trouble. It might be



Correct and Incorrect Methods of Feeding Coiled Stock to Combination Die

mentioned here that if the die had been properly constructed, with the cut-off die the same height as the forming die, it would have been impossible to feed material into the die the wrong way, as indicated at *C*.

Philadelphia, Pa. EUGENE L. SOLTNER

"Warming Up" Drills and Broaches to Prevent Breakage

Some plants make it a practice to "warm up" the points of new twist drills before the drills are put into operation. It is claimed that this prevents a great deal of drill breakage, especially on the larger sizes. The drill is warmed by feeding the lip into the work and allowing it to run there for one or two minutes until the proper heat is generated. Broach breakage can be avoided, also, by heating the broaches in a trough of water having a temperature of about 80 degrees F.

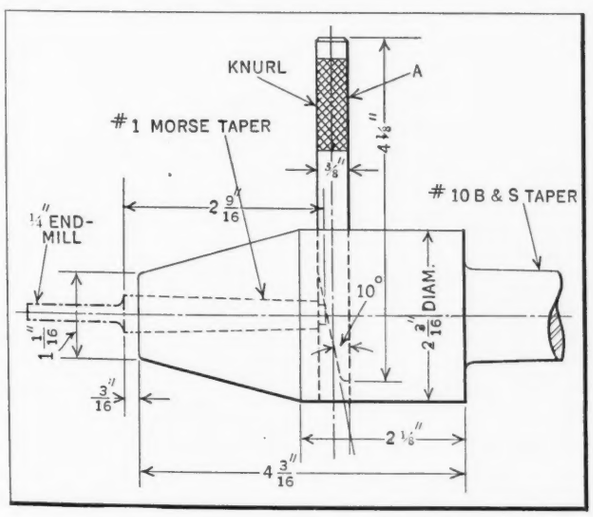
Boston, Mass. CHARLES R. WHITEHOUSE

Taper Adapter for Milling Cutters

A number of taper adapters like the one here illustrated were made up recently by the writer for use on a No. 2 Cincinnati milling machine. They were made especially for use in splining operations, but have been found convenient for many jobs where small end-mills and drills with No. 1 Morse taper shanks can be used to advantage in spindles having a No. 10 B&S taper.

The drift-pin *A* provides for the removal of the tools. The rear end of the No. 10 taper shank is drilled and tapped to fit the draw-in rod. The use of a solid adapter of this type instead of two or more separate taper sleeves is obviously better practice, especially on precision work.

Millersburg, Pa. R. A. DRESSLER

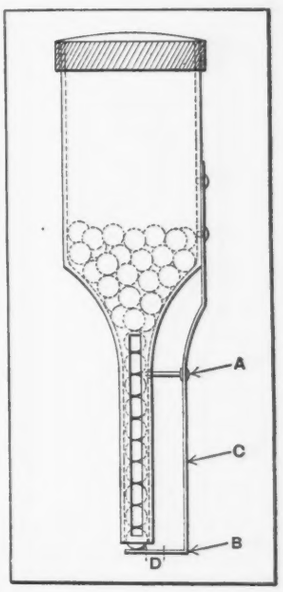


Adapter that Permits Small Taper-shank End-mills to be Used in Taper Sockets of Large Spindles

Hand-Operated Hopper for Assembling Balls

The accompanying illustration shows a hand-operated hopper used for assembling balls into such parts as ball-bearing races. The number of balls released at one time is governed by the distance the pin *A* is located from the bend *B* in the flat spring *C*.

As pressure is applied to this spring by the operator's fingers, pin *A* passes through a hole in one side of the hopper stem, and prevents the balls above the pin from passing down the stem. At the same time, a hole *D* in the spring is brought into line with the hole through the stem, and all the balls beneath the pin drop out. As shown, the device is set to feed eight balls at one time.



Hopper for Assembling Balls into Races

In making this hopper, it is advisable to mill a narrow slot through one side of the stem to within 1/4 inch of the lower end. This slot will then serve as a sight hole so that the operator may be assured that the stem is entirely full before spring *C* is released. D. C.

[It is obvious that some means must be employed to agitate the balls so that they will pass into the hopper stem readily. The arrangement used for this purpose, however, is not shown, as the author intended only to illustrate the principle involved in ejecting the balls from the stem.—EDITOR]

* * *

June Meeting of Tool Engineers

At the meeting of the American Society of Tool Engineers (8316 Woodward Ave., Detroit, Mich.), held June 9 at the Detroit-Leland Hotel, Detroit, Mich., Frank Curtis, research engineer of the Kearney & Trecker Corporation, Milwaukee, Wis., spoke on the subject, "What Tool Engineers Should Know About Tungsten Carbide." Mr. Curtis discussed the applications of tungsten and tantalum carbide to milling operations and pointed out the savings in costs and time that have been made by applying the new cutting materials. Louis Ruthenburg, president and general manager of the Copeland Products, Inc., Mount Clemens, Mich., spoke on the subject, "The Relation of the Tool Engineer to Management." Mr. Ruthenburg is well known for his forward-looking ideas and ideals in the field of management.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

L. C. W.—Several months ago we purchased a second-hand planer and matcher for $5200. The seller, in a letter, guaranteed the machine to be in first-class condition and to do work equal to a new machine. Upon receipt of the machine, we found that it was not in first-class condition. The sprocket wheel and chain were broken and worn, some of the teeth in the gear wheel were broken, one of the pulleys had been lost or removed from the countershaft, the feed table was in unrepaired condition, and bearings were old and worn.

In order to avoid litigation we offered to pay $3500, estimating, to the seller, that $1700 was required to put the machine in good condition. The seller refused to accept this offer. We proceeded to expend time and money in repairing and installing the machine. We have lost much money through loss of profits on material that we had intended to complete by the use of the machine, but could not complete on account of the poor condition of the machine. We now estimate our damage at $3000. Do you believe we can collect this amount?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

Your question is answered by a recent case, (110 So. 397). In this case, a buyer purchased a used machine at $4200, but when he discovered that the machine was not in the condition guaranteed by the seller he offered to make allowance for the poor condition of the machine by deducting $1000 from the original price. The seller refused the offer, and the buyer returned the machine and sued for $5000 damages in labor cost, repair cost, and loss of profits as a result of not being able to use the machine. However, the Court allowed the buyer only $771 damages in view of the offer to compromise the case at $1000.

The machine should have been returned as soon as it was found that it was not up to the guaranteed quality. Never attempt to repair a machine under these circumstances and expect to sue and recover full damages from the seller.

Chromium-Plating for Wear

By W. S. BROWN, Auburn, N. Y.

While the writer has had no experience with high-speed unlubricated bearings, such as mentioned in A. B.'s inquiry in May MACHINERY, he has recently had experience with chromium-plating the steel drum of a blueprint drying machine. The original drum was apparently made from steel well casing, 12 inches in diameter by 1/4 inch thick by 42 inches long. The drum was polished before plating and the plating was supposed to consist of polished chromium deposited on nickel, which, in turn, was deposited on copper.

The drum was in the plating plant, where all the preparation and plating was done, for twelve hours. When the job was completed, there were suggestions of blisters near one end, probably caused by standing the drum on that end after dipping it in the cleaner bath and allowing some grease or other foreign substance to collect, thereby preventing proper adhesion of the plating to the drum.

On the drying machine there are about twelve 1 1/4-inch fingers of spring steel that bear lightly on the drum, with the ends facing against the direction of rotation. These serve to remove the dried prints as they pass out of the roll. After the machine had been in operation three days, the plating peeled off the drum in the neighborhood of the blisters, this happening to coincide with the track of the bearing rollers which supported the drum underneath. The thickness of the combined plating, as shown by the peelings, was 0.004 inch. White metal appeared next to the steel drum, with copper next and white metal on the outside. The plating from a damaged automobile bumper was found to be at least three times as thick. Where the fingers came in contact with the drum the plating wore through in about sixty hours of service, with the drum rotating at a surface speed of 2 1/2 feet per minute. The writer would guess the thickness of the actual chromium-plating to be not more than 0.0005 inch. From the foregoing experiences, the writer would warn any engineer specifying chromium-plating that must withstand wear, to make clear to the platers the type of service required. It would be well also to obtain guarantees of performance.

In this particular case, it is probable that the chromium-plating was not properly done, although the plating company had had wide experience on automobile lamps, etc.

* * *

It seems to be pretty well established in the business mind of America that what we call "economic planning" must have a definite place in the commercial future of our country. In a world where economic conditions are shifting and turning as sand dunes shift and turn before the desert winds, we are recognizing that economic stabilization and economic control have become vital necessities.—*Frederick M. Feiker,* Director, Bureau of Foreign and Domestic Commerce.

Rolling Down Burrs in a Power Press

Instead of Spending His Time on an Awkward Filing Operation, the Operator Simply Keeps the Magazine Filled and the Parts are Ejected from the Die by Gravity

By J. E. FENNO

ONE of the many unusual jobs to which the standard power press is readily adapted is that of rolling down burrs on cylindrical parts. A die used for this work is shown in Fig. 2. Here the burrs raised in a previous slotting operation on electrical switch posts are rolled down by passing the parts between a moving and a stationary plate. The posts, shown in detail in Fig. 1, are fed to the die by a magazine chute, and after the burring operation is completed, they are ejected by gravity.

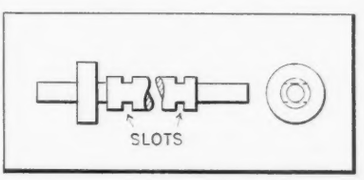


Fig. 1. Electrical Switch Post Burred in Die Shown in Fig. 2

The die consists primarily of the base *A* on which is mounted the slide *B*, the stationary plate *C*, and the magazine chute *D*. The slide *B* is given a reciprocating movement by the lever *E*, which turns about a stud in the stationary bracket *F*. The lower end of this lever engages a rectangular slot cut in the slide, while the other end is pivoted in a block fastened to the ram of the press. Consequently, as the ram moves up and down, an oscillating movement is imparted to the lever, which, in turn, transmits the required reciprocating movement to the slide.

In burring, the operator simply keeps the chute *D* filled. In the position indicated in Fig. 2, the slide *B* is at the end of its stroke and is about to move in the direction of the arrow. As this movement takes place, the spring-actuated transfer fingers *G* (see Fig. 3) carry the lowest post along until it is gripped tightly between the plates *C* and *H*, the latter being fastened securely to the slide by screws.

In the meantime, the latch *J* holds the other posts up in the chute. Continued movement of slide *B* causes the first post to be rolled between plates *H* and *C*, thus smoothing down the burrs.

This rolling action continues until the post passes the end of plate *C*, at which time it drops through the rectangular hole *K* in the bolster and into a container on the floor. At this point the end of the stroke has been reached. However, just before the

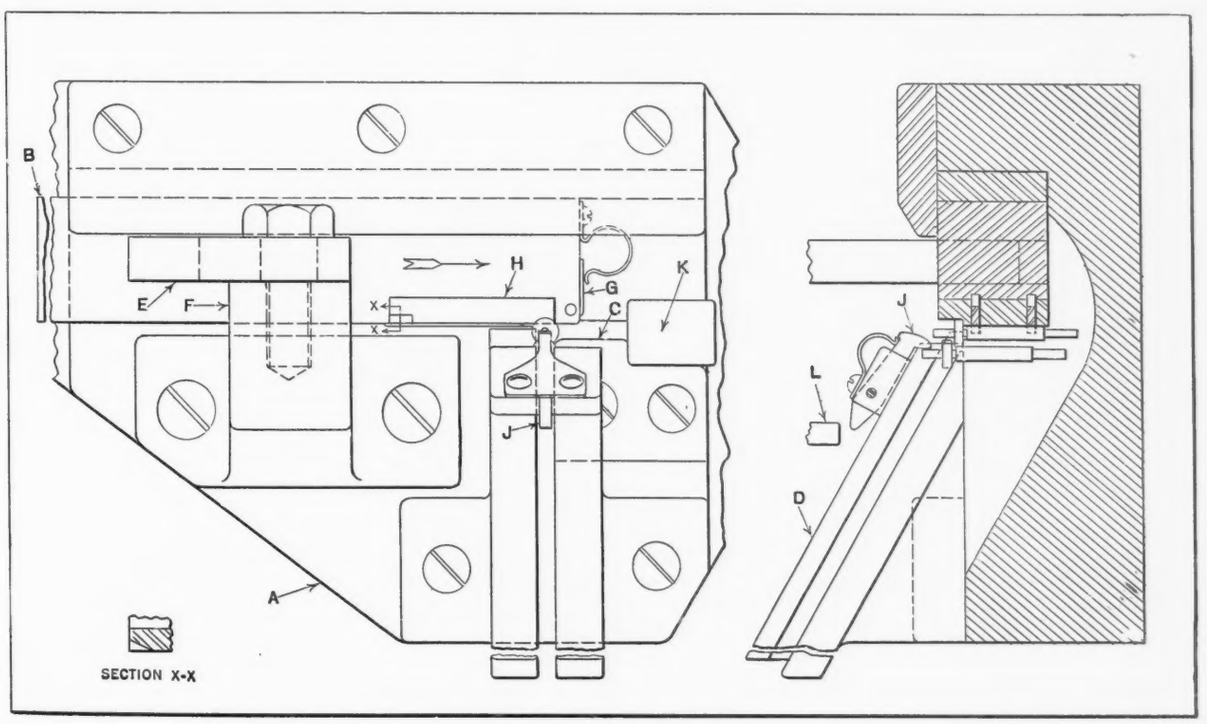


Fig. 2. Die in which the Parts Shown in Fig. 1 are Burred by Rolling them Between a Stationary and a Movable Plate

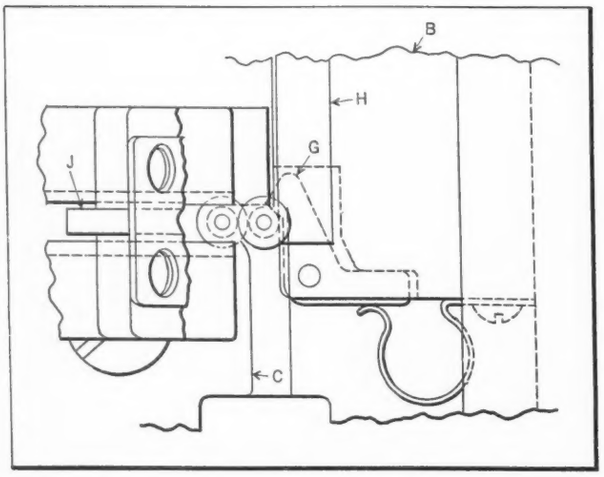


Fig. 3. Action of the Transfer Fingers in the Die Shown in Fig. 2

end of the stroke, the stop *L* fastened in the block on the press ram depresses one end of latch *J*, raising the other end and allowing the posts to slide down the chute until the lowest one comes in contact with slide *B*. As the slide now returns to the starting position shown, the transfer fingers *G* are depressed when they pass the lowest post. This completes the cycle of movements.

In order to prevent the burred posts from hanging on plate *H* at the time of ejection, this plate is beveled as indicated at section *X–X*. Though not shown, adjustment of the plate *C* is provided, so that the proper pressure against each post can be maintained.

The type of die described is particularly suited to the class of work mentioned because of the high production obtained, as compared with the previous method of removing the burrs by hand-filing. Moreover, any distortion resulting from the slotting operation (which is also done in a power press) is corrected by the rolling action.

* * *

Comments on Mechanism Articles

By FREDERICK FRANZ

Referring to two of the mechanisms described on pages 740 and 741 of June MACHINERY, the writer would like to make the following comments:

In the illustration of the pin and slotted-disk driving mechanism on page 740, left mechanism, let ω equal the angular velocity of the driver. Then ωR is the lineal velocity of the pin and ωR sin 45 degrees, or 0.7071 ωR, is the lineal velocity of the driven slotted disk at its pitch line in the position in which the mechanism is shown. The corresponding angular velocity of the driven disk at this instant is $0.7071 \frac{\omega R}{r}$. An instant before this, the angular velocity of the driven disk was zero.

Therefore, instead of having the characteristic of slow starting, as is stated in the article, the acceleration of the driven disk at the instant of starting is actually infinitely great. Furthermore, it would be impossible to construct the mechanism as is shown, because the driving pin would strike the corner of the slot before it could reach the position shown.

Referring to the ratchet pawl having a slow movement at both ends of the stroke, on page 741, there is nothing new in having it crank-driven. In fact, of all the pawls in use on machinery, a fair estimate is that over 90 per cent are crank-driven. Elimination of over-run at the ends of the stroke is not necessarily attained by crank-driven pawls. The maximum retardation in this form of drive occurs at the end of the stroke, a fact which may not be generally known. Unless the frictional resistances are great enough to keep the ratchet in contact with the pawl at the end of its stroke, it will over-run.

Furthermore, the mechanism, as shown, illustrates a common fault in ratchet design which will yield a slight impact at the beginning of its stroke. The cause of this impact is this: The acting faces of the ratchet teeth are vertical, but the path of the pawl tip when dropping into action is oblique. Therefore, as the pawl just drops off the top of the ratchet tooth, it departs from the acting face of the tooth, leaving a clearance. Since the clearance must be traversed by the pawl before the movement of the ratchet begins, the crank cannot start its work at dead center, and impact occurs. The remedy is to make the acting face of the ratchet coincident with the path of the pawl when dropping.

* * *

The National Metal Congress in Buffalo

In connection with the National Metal Congress to be held at Buffalo, N. Y., during the week beginning October 3 under the auspices of the American Society for Steel Treating, the Machine Shop Practice Division of the American Society of Mechanical Engineers and the Production Activity Division of the Society of Automotive Engineers will hold sessions.

The American Drop Forging Institute will also hold meetings during the National Metal Congress. This Institute holds two meetings a year, one at which the executives meet, and the other at which not only the executives, but industrial and technical men from the forging plants assemble for the discussion of important problems dealing with this particular branch of the industry. It is the meeting of the technical and engineering men in the forging industry that will be held in Buffalo.

Up to the middle of June nearly one hundred companies had reserved space in the National Metal Exposition, which will occupy 50,000 square feet in the 174th Regiment Armory. This building is unusually suitable for an exposition of this kind, as it has an immense hall, free from pillars and other obstructions, which is large enough to accommodate all the booths on one floor.

Getting Best Results from Belted Motor Drives

A Brief Review of the Problems Met with in Using Motor Belt Drives and Suggestions for Overcoming the Difficulties Encountered

By ROBERT W. DRAKE

A MOTOR belt drive planned intelligently gives long and satisfactory service. It runs for a long time without any attention, except one belt-shortening when the belt is new, and sufficient care to keep the leather from drying out.

In operating machinery by motors, it is frequently required to increase the load, the speed, or the output of the driven machine. When this happens, some changes must be made in the belt drive to adapt the belt to the new condition. These changes are relatively simple, if properly understood.

Difficulties sometimes arise from the fact that a very small pulley drives a large one on short centers, with a violently fluctuating load having extreme peaks; or it may be that, through no fault of the user, a motor is operating with a motor pulley considerably smaller in diameter than the minimum diameter pulley specified by the manufacturer of the motor, which may cause bearing trouble. The belt speed may have to be increased; the motor may run too hot; the belt life may seem too short—all of these are special conditions to which the belt drive must be adapted. It is the aim of this article to help the operator to recognize such special conditions, and to tell what to do and how to do it so that the belt drive will be free from trouble.

Proportioning the Belt to the Drive

A belt that will carry 10 horsepower is not necessarily suited to a 10-horsepower motor. The momentary overloads during starting and running determine the belt drive needed. Too often a belt drive is proportioned by considering average running conditions, but the belt must carry the peak loads as well as the running load. This accounts for a large proportion of belting troubles.

Fully one-half of the belted motors in industry require a heavier belt for starting than is required for satisfactory running. Practically all three-phase alternating-current motors which start on the line, and many direct-current motors, develop from one-third to one-half more belt pull when starting than when operating at full rated load. Wound rotor motors sometimes, and high-slip line-start motors always, develop twice the normal full-load belt pull at starting.

When alternating-current line-start motors reach about three-fourths of full speed or when compensator-start motors are thrown over onto the line before they rise much above three-fourths of full speed, the belt pull rises to double the full load for a time—a short time with an easy starting load which comes up to speed quickly, and a longer time with a slow starting load.

The motor determines the belt pull during starting without reference to the requirements of the load. Any pull available in excess of that necessary to overcome the starting resistance is used in bringing the load up to speed more quickly. A belt that will carry an excessive pull momentarily on an easy starting load will frequently come off on a load that takes longer to start if the excessive pull lasts for several seconds. The belt drive from a motor, therefore, must be capable of carrying about twice the normal full-load belt pull, at least for a short time during starting. For many 60-cycle motors, operating at 1800 revolutions per minute, and for all high-slip motors, the belt must transmit two and a half times the full-load pull.

It is permissible to overload a belt while starting a load, for considerable slip at starting may be tolerated. But after the motor is up to speed, what is the maximum belt pull likely to be? This is a hard question to answer. It depends upon the type of driven load. For loads having high momentary power peaks, such as a drill press when the drill breaks through or a small group of, say, three machines which may occasionally work into step, most motors, when confronted with momentary demand for maximum power, will deliver double the normal full-load belt pull. Some high-speed motors and high-slip motors will deliver two and a half times the full-load pull.

Increasing the Capacity of the Drive

If the capacity of the drive planned with the motor manufacturer's standard pulleys must be increased, what should be done? There are a number of expedients that will help: (1) Putting on paper pulleys, if the old pulleys are of wood or metal; (2) securing higher belt speed by means of larger-diameter pulleys; (3) using a pivoted motor base; (4) using gravity idler drives; (5) putting on a wider belt (provided the bearings will stand the belt pull necessary if a wider belt is to carry additional load). Combinations of two or three of these methods are all that are possible in any one case.

The Use of Paper Pulleys

When the smaller pulley of the drive is not of paper, an increase of 25 per cent in drive capacity can be obtained by installing a paper pulley. Since all motor manufacturers furnish paper pulleys, they are generally used on the motor, but in speed-up drives the driven pulley is the smaller and should also be of paper. Even on drives where the driven pulley is the larger, a worthwhile improvement in

capacity and a decrease in slip may be obtained by substituting a split-paper driven pulley.

Advantages of Higher Belt Speed

The faster a belt is run, up to 5000 feet per minute, the more horsepower it will carry. Above 4500 feet per minute the gain in horsepower is not large. Except for medium and large 1750 revolutions per minute motors and large 1140 revolutions per minute motors, manufacturers' standard pulleys give belt speeds decidedly below 4500 feet per minute. In many cases it is possible to increase materially the horsepower capacity of an existing drive by increasing the belt speed without exceeding 4500 feet per minute. The cost of two pulleys and a slight increase in belt length is moderate. Substantial increases in drive capacity are easily obtained without any increase in belt width, belt tension, or motor bearing loads.

On the smaller sizes of motors, the belt speed can be increased more than is usually required—several hundred per cent in many cases. On medium sizes of motors, operating at less than 1800 revolutions per minute, the belt speed can be increased enough to remedy ordinary "trouble" jobs. Higher belt speeds can often be used when the drive carries the load satisfactorily but the motor bearings heat dangerously. By substantially increasing the belt speed, a narrower belt can be used or the old belt can be run slack and the bearings greatly relieved.

Wherever the motor pulleys in service are smaller than the sizes tabulated below, higher belt speed should be considered first of all when relief is desired for an overloaded drive.

1140 r.p.m. motor, 15-inch pulley
850 r.p.m. motor, 20-inch pulley
690 r.p.m. motor, 25-inch pulley
570 r.p.m. motor, 30-inch pulley

In some cases, the belt speed cannot be increased. For instance, on a large 1800 revolutions per minute motor, where the belt is running at 4500 feet per minute or more, it cannot be done. It may also be found impossible to increase the driven pulley size because of interference with the ceiling, floor, or the frame of the driven machine.

The Application of Wider Belts

The use of a wider belt is ordinarily the solution that is first thought of when a belt drive, operated at reasonable tension, will not start the load or fails to carry the extreme load fluctuations. However, with motor belts, this is not usually the best solution of the problem.

Many shops endeavor to keep all motors of one horsepower capacity to one speed, so as to simplify the stocking of spare motors for use in case of motor breakdown. In fitting the shop standard-speed motor to individually driven machines, cases arise where a wider belt than standard must be used. Perhaps the diameter of the driven pulley is fixed, as in a compressor or a punch press, in which case the motor pulley must be somewhat smaller than the standard for that motor. Here greater belt width is needed because of lower belt speed.

It is worth while to point out here that if it is possible to use a motor pulley that is not smaller than the motor manufacturers' standard diameter, by means of any reasonable expedient, it is the thing to do. The great majority of all troubles from motor drives result from using motor pulleys smaller than the standard. With a smaller pulley, belt life is shortened. If the pulley diameter is to be decreased, the belt must be wider and in about the same proportion. The product of pulley diameter and face width should be kept the same as for the standard motor pulley. If this cannot be done, then a pivoted motor base or gravity idler is advisable.

With a wider belt, the load on the motor bearing will be greater than normal, the bearing life will be shorter, and the bearing operating temperature will be higher than normal.

There is some allowance in the design of motor bearings for the over-tightening of belts or for some slight increase in belt width, but this allowance is small in large high-speed motors.

All motor manufacturers furnish tables showing the widest belt and the corresponding smallest pulley that any given frame, operated at any given speed, will stand without dangerously overloading the bearings. It is worth while for the plant engineer to provide himself with these data, covering the lines of both the modern and the older motors that he is using.

In the absence of such data, a few general suggestions may be helpful. With the exception of motors built more than twenty or twenty-five years ago, very few 1750 revolutions per minute sleeve-bearing motors above 25 horsepower will stand any increase in belt width at all. This is likewise true of 1140 revolutions per minute motors of 50 horsepower and above.

Almost all 20- and 25-horsepower, 1750 revolutions per minute motors; 30-, 35-, and 40-horsepower, 1140 revolutions per minute motors; and 40- to 100-horsepower, 850 revolutions per minute motors will stand at least a 20 per cent increase in belt width—some 30 per cent or more. Smaller motors, say up to 10 horsepower, will generally stand belts 30 per cent wider than standard, many will stand 40 per cent, and some even 50 per cent, the latter particularly in sizes of 5 horsepower and below.

However, there are exceptions to the above rules. If the bearings run very hot, wider belts are not to be thought of. If moderately hot, the belts should be only 10 per cent wider—or 20 per cent if a pivoted motor base is installed to reduce the chance of melting out a bearing by overtightening the belt.

The Use of Roller Bearings

In the case of motors with ball bearings, one expedient frequently saves the day in medium and smaller sizes of motors. There are available roller

bearings, interchangeable with standard ball bearings, which, within their speed limitations, will carry about twice the load of standard ball bearings. When the speeds are not too high relative to the shaft diameter, in medium and small sizes of motors, any reasonable increase in belt width is permissible with these roller bearings in the pulley bearing and deep-groove ball bearings in the front end to take the thrust. This permits belts 50 per cent wider than standard in almost all cases of 15-horsepower motors or less, and belts almost double standard width in small motors, particularly with the use of a pivoted motor base.

Using a Pivoted Motor Base and Gravity Idler

The pivoted motor base and gravity idler types of drive are particularly useful when motor drives must be installed on very short centers. In fact, if, with short centers, is combined a considerable difference in pulley sizes, some such special drive is almost a necessity. In some respects, the performance of these drives is similar.

A belt does all its work on the tight side, but there must also be a considerable pull on the slack side to make the belt grip the pulley and prevent slippage. With an ordinary belt drive, as the load comes on, the tight side stretches and passes extra length around into the slack side. The pivoted motor base and the gravity idler drive greatly reduce, in most cases, the pull on both the tight and the slack side of the belt at all loads except extreme overloads. Even at extreme overloads, they afford considerable relief, for they make it unnecessary to have the drive tighter than is needed for average operation. The motion of the pivoted base or the gravity idler takes up the stretch.

Ordinary belt drives on motors operate at an average motor load not much exceeding the motor rating, but the belt tension must be sufficient to enable the belt to carry about double the corresponding pull momentarily during starting, as well as during operation. A gravity idler or pivoted motor base properly adjusted will carry heavier intermittent loads than an ordinary drive without overheating the motor bearings, for the load on the motor bearings will be decreased during periods of light load and normal load. During periods of abnormal load, the bearing pressures will approach those of an ordinary open drive, but such periods do not last long enough to overheat the bearings. Similarly, belts last longer if they are tightened to carry extreme loads only during occasional overloading, and do not run as tight as this the remainder of the time.

On such a drive, properly adjusted, it is safe to use a belt slightly wider than could be used on the same motor with an ordinary drive. This is a "life saver" when pulleys smaller than standard are necessary on fairly high speed motors.

When the pulley ratio is within reason, a pivoted motor base drive has decided advantages. The gravity idler drive produces a reverse bend in the belt which reduces the belt life. A double belt is subjected to more severe treatment when it has a reverse bend around a 6- or an 8-inch roller as it leaves a 12-inch driving pulley than when it runs on a 6- or an 8-inch driving pulley without reverse bending.

With the pivoted base, the belt creep and slip within the capacity of the drive is so low as to be practically negligible, being normally less than one per cent.

The efficiency of the gravity idler drive is slightly less than that of the pivoted base drive, for there is some roller friction and roller windage, and a slightly longer belt is required, thus increasing belt-windage losses.

The suggestions given in this article should aid greatly in preventing trouble with flat-leather motor belt drives.

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Foremen Meet in National Convention

The ninth annual convention of the National Association of Foremen was held at the Mansfield-Leland Hotel, Mansfield, Ohio, June 3 and 4. The first day was devoted largely to plant visits, while the second day was occupied by meetings and conferences. A. D. Lynch, president of the Association, in his opening address, dealt particularly with Association problems. Conferences were held covering the following subjects: Increasing Man Power through Management; The Effect of Idleness on the Physical Condition of the Worker; The Cost of Plant Maintenance; The Technique of Scientific Job Analysis; The Six-hour Day; Unemployment Insurance; Time Study and Wage Incentive Plans; and Budgetary Control. Samuel S. Wyer, consulting engineer, Columbus, Ohio, read a paper entitled "Startling Facts of Today's Economic Muddle," while C. C. Slusser, vice-president and general manager of the Goodyear Tire & Rubber Co., Akron, Ohio, spoke on the subject "The Factory's Responsibilities to the Merchandising Side of Industry." E. H. Tingley, Refiners' Building, Dayton, Ohio, is secretary of the Association.

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Turning Cylinder Sleeves with Tungsten-Carbide Tools

On page 692 of May MACHINERY, reference is made to the turning of cylinder sleeves at the Moline Tool Co.'s plant, Moline, Ill. Our attention has been called to the fact that it is not definitely pointed out that while tungsten-carbide tools are used for turning the sleeves, the majority of the sleeves are bored with a good grade of tool steel, four at a time being bored, using multiple-blade cutters, each of which has eight cutting edges. The outside of the sleeves, however, is machined with tungsten-carbide tools, because it was found impossible to obtain reasonable production with high-speed steel tools.

A Rubber Substitute that is Not Affected by Gases and Liquids

"Thiokol" is a new chemical product that is said to possess practically all the characteristics of rubber and the additional advantage that it is not affected by solvents. Because of its unusual resistance to the deteriorating action of most gases and liquids, it has been adopted in the automotive and other fields. For instance, it is used on one automobile in the form of tubing for conveying gasoline to the carburetor. Rubber would be impractical for such an application because of its tendency to swell and deteriorate in the presence of gasoline. It would also break because of engine vibration.

This new product has also been used as a covering for ignition wire to protect it against oil and corona conditions. Other uses include paint-spray hose, gaskets for electrical refrigerators, linings for tank cars used in conveying acids and solvents, and protective covering for underground cables. This new material is made by the Thiokol Corporation, Yardville, N. J.

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Trade Executives' Employment Service

The American Trade Association Executives, 45 E. 17th St., New York City, is an organized group of several hundred trade association managers. Because of present business conditions, a number of these men, who have been highly trained in trade promotion and industrial organization, are available for new connections. The aid of the trade press has been enlisted in acquainting progressive corporations with this fact, so that in case men of this type are required, the Placement Committee of the Association may be called upon for assistance. It is suggested that executives who are interested in becoming acquainted with men trained in trade promotion and organization work communicate directly with the office of the American Trade Association Executives.

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The Applied Mechanics Division of the American Society of Mechanical Engineers held its second national meeting at Yale University, New Haven, Conn., June 23 to 25. Special sessions were devoted to hydro-dynamics and aero-dynamics, vibration, stress analysis, elasticity and plasticity, and thermal stresses. A joint session was arranged with the American Physical Society.

A Successful Group Piece-Work System

The Brunswick Radio Corporation has applied a group piece-work system through which both the company and the men have profited by effective teamwork. The system develops the initiative and responsibility of each man. It was first tried on some sub-assembly jobs, and the results were so successful that it is now applied to a wide range of manufacturing operations. An article in August MACHINERY will describe how the system is handled and will summarize the principal advantages that are obtained. One of the interesting facts about the system is that it has been successfully applied in departments where as many as ninety different parts are produced, the press department being one of these. One of the results is that factory timekeeping has been reduced to a minimum, one timekeeper being able to keep the time for 750 employes.

American Society of Mechanical Engineers Meets in Canada

The American Society of Mechanical Engineers is holding its annual summer meeting, just as MACHINERY goes to press, at Bigwin Inn, Lake of Bays, Ontario, the dates for the meeting being June 28 to July 1, inclusive. Sessions are being held by the divisions of Machine Shop Practice, Oil and Gas Power, Railroads, Applied Mechanics, Hydraulics, Power, and Management. Twenty-four papers pertaining to the interests of these divisions will be read.

The papers in the machine shop practice field are as follows: "Oxygen Machine Cutting in Great Britain," by C. G. Bainbridge; "Developments in the Design and Application of Gearing," by Henry E. Merritt; "Research on Steels and Forgings for Greater Density, Machineability, and Durability," by Fred W. Cederleaf and W. E. Sanders; and "Life of Tools Machining Free-cutting Brass," by L. D. Spence and James A. Hall.

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A Tribute to an Engineering Pioneer

A meeting of appreciation and tribute to Frank J. Sprague, pioneer in the development of electric motors, electric railways, electric elevators, and other applications of electricity, will be held Monday, July 25, at 8 P. M., in the Engineering Societies Auditorium, 29 W. 39th St., New York City, to which all interested are invited. The meeting will be held on Mr. Sprague's seventy-fifth birthday; he was born at Milton, Conn., July 25, 1857. Few engineers have left a record of so many achievements in industry as Mr. Sprague, of whom one of his friends has said: "As a pioneer who personifies vision, persistence, courage, energy, and zeal, he is an unsurpassed example."

* * *

The exports of industrial machinery from the United States during the month of April amounted to $4,900,000, according to statistics published by the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce. Of this total, metal-working machinery accounts for $1,316,000, a considerable falling off from the figure for April a year ago, which was $2,807,000. However, the figures represent an increase over March this year, when the total of metal-working machinery exports was only $1,054,000.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies Can be Obtained by Writing Directly to the Manufacturer, Mentioning MACHINERY.

MAGNESIUM ALLOYS. Dow Chemical Co., Midland, Mich. Catalogue on Dowmetal magnesium alloys, covering the properties of these alloys, general shop practice relating to methods of fabricating and finishing, available forms in which magnesium alloys can be obtained, and practical data for the designing engineer. Circular entitled "Industry's Lightest Structural Metal," describing the many applications of Dowmetal where light weight is an essential factor. Booklet entitled "The Magnesium Industry," containing an outline of the history of this industry, foundry practice, fabrication, and uses.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Booklet entitled "Lubrication of New Departure Ball Bearings," containing a complete study of the subject of ball-bearing lubrication. The treatise is based upon extensive research by engineers of the New Departure Mfg. Co. The booklet is well illustrated with clear line engravings, and covers oils, greases, procedure to follow in using oil, oil level systems, splash feed, drop feed, atomizing or spraying, circulating oil feed, wick feed, and procedure to follow in using grease.

BELTING. Graton & Knight Co., Worcester, Mass. Booklet entitled "Research Leather Belt Rating Tables for Economical Power Transmission." This booklet contains specific suggestions for obtaining substantial savings through the correct application of leather belting, and includes tables and charts for determining the size and type of belt required for any specified service. The booklet applies specifically to the new type of belting known as "Research Leather Belting."

CARBOLOY TOOLS. Carboloy Co., Inc., 2481 E. Grand Blvd., Detroit, Mich. Handbook and catalogue M-32 of Carboloy tools. This publication contains, in addition to the customary list of tools made by this company, an extensive section devoted to the manufacture, design, operation, and maintenance of Carboloy tools and a supplementary section containing the listing of other tool manufacturers licensed to supply their tools equipped with Carboloy cemented carbide.

PIPE THREADERS. Borden Co., Warren, Ohio. Leaflet containing data on the No. 17 Beaver pipe threaders, which may be operated either by hand or power and are made in sizes of from 1/4 inch to 2 inches, inclusive. The circular also illustrates the Beaver power adapter, a worm-driven die-stock using interchangeable die-heads for threading all kinds of pipe from 1/2 inch to 2 inches in size.

MATRIX ALLOY. Cerro de Pasco Copper Corporation, 44 Wall St., New York City. Catalogue giving the composition and physical properties of Matrix alloy, an alloy consisting of bismuth, lead, tin, and antimony, which has been developed for the mounting of dies and punches. The booklet shows various examples of punch and die lay-outs in which Matrix alloy is used.

NICKEL STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Volume 1, No. 1, of a new publication entitled "Nickel Steel Topics," which will be devoted to the interests of users and fabricators of nickel-alloy steels. This publication will be issued twice a month, and will contain information dealing with the production, treatment, and uses of nickel steels.

STEEL. Electro Metallurgical Co., Unit of Union Carbide & Carbon Corporation, 30 E. 42nd St., New York City. Bulletin CV-1, containing information on the properties and advantages of chrome-vanadium nitriding steel. Bulletin CMS-1, outlining the properties and applications of certain steels containing chromium, manganese, and silicon, known as Cromansil steels.

ELECTRIC EQUIPMENT. Wagner Electric Corporation, 6467 Plymouth Ave., St. Louis, Mo. Bulletin 172, covering all types of distribution transformers. The bulletin is issued in loose-leaf form so that it can be conveniently kept up to date. Bulletin 167, illustrating and describing Wagner capacitor motors, which are made in rubber-mounted and rigid-mounted types.

ARC-WELDING EQUIPMENT. Harnischfeger Corporation, 4400 W. National Ave., Milwaukee, Wis. Bulletin entitled "The Novice Understands and the Expert Appreciates," describing in detail the construction and operating advantages of the P & H-Hansen arc welder, which is now manufactured exclusively by the Harnischfeger Corporation.

COPPER AND BRASS PRODUCTS. Revere Copper & Brass, Inc., 230 Park Ave., New York City. Catalogue containing information on the general properties and applications of "Herculoy," an engineering bronze furnished in rolls and strips, sheets and plates, rods and shafting, forgings, welding rods, and ingots for sand-casting.

LEATHER BELTING. Alexander Bros. Inc., 14 South St., Philadelphia, Pa. Catalogue A-103, comprising a power transmission guide for leather belt drives. Various applications and designs of leather belt drives are shown and considerable information is given of value to those interested in power transmission.

NICKEL ALLOYS. International Nickel Co., Inc., 67 Wall St., New

York City. Nickel cast iron composition chart designed for engineers and foundrymen. The chart automatically gives chemical analyses and mechanical properties of nickel cast iron compositions for forty-nine important applications.

LEAD-ENCASING PRESSES. John Robertson Co., Inc., 123 Water St., Brooklyn, N. Y. Circular entitled "Over the Rim where the Future Lies," describing Robertson lead-cable encasing presses used for extruding lead sheath on electric wires and cable, as well as on rubber hose for vulcanizing purposes.

WELDED STEEL CONSTRUCTION. Lukenweld, Inc., Division of Lukens Steel Co., Coatesville, Pa. Bulletin 2, showing nearly one hundred illustrations of welded machinery parts or machinery equipped with welded parts. Data concerning the advantages of this construction are included.

ELECTRIC EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Bulletin 940-A, containing data on Type H nickel-alloy resistors for application where severe service is encountered, such as in open-hearth charging machines, traveling cranes, and steel mill machinery.

MATERIAL-HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the application of the Cleveland overhead tramrail system for moving loads mechanically in foundries.

AUTOMATIC SEPARATORS. Leavitt Machine Co., Orange, Mass. Catalogue A, descriptive of the Swendeman automatic separator for removing water and oil from compressed air lines. In addition to sizes and prices, suggestions for installation are given.

SHEARS. Cincinnati Shaper Co., Cincinnati, Ohio. Catalogue descriptive of the Cincinnati all-steel shear, with hydraulic hold-downs. A data sheet containing dimensions, capacities, and other specifications for the various sizes is included.

FLEXIBLE COUPLINGS. American Flexible Coupling Co., Erie, Pa. Bulletin 102, illustrating and describing American flexible couplings. Information on how to select the correct coupling and methods of lubricating and installing are given.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Catalogue 2246, covering Westinghouse "Nofuze" load centers, panelboards, switchboards, and industrial breakers using "De-Ion" circuit-breakers.

NICKEL STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Circular No. 8-A in a series on nickel-steel data and applications, containing information on the composition, properties, and applications of nickel alloy steel castings.

POWER TRANSMISSION EQUIPMENT. Worthington Pump & Machinery Corporation, Harrison, N. J. Bulletin L-400-B2A, descriptive of multi-V drives, which consist of rubberized cord belts operating in V-grooved sheaves.

SHEET-METAL WORKING MACHINES. Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Bulletin 76, illustrating and describing hand- and power-operated grooving machines and double seamers.

ELASTIC STOP-NUTS. Elastic Stop Division of the A.G.A. Co., Elizabeth, N. J. Circular descriptive of applications of elastic stop-nuts in various fields, including aviation, radio, electrical, transportation, etc.

GRAPHIC METERS. Esterline-Angus Co., Indianapolis, Ind. Bulletin 632, announcing a new and complete line of graphic meters which are available in eleven different types of cases to meet all requirements.

ELECTRIC MOTORS. Ideal Electric & Mfg. Co., Mansfield, Ohio. Bulletin 210, containing a complete description of the design, characteristics, and construction of the Noel polyphase capacitor motors.

POWER TRANSMISSION EQUIPMENT. Reeves Pulley Co., Columbus, Ind. Circular describing the Reeves variable-speed transmission and illustrating typical installations on a variety of machines.

DIE SETS. Allied Products Corporation, Richard Bros. Division, 1560-74 Milwaukee Ave. East, Detroit, Mich. Circular containing lists of standardized die sets, including prices and weights.

CORROSION-RESISTING STEEL. Duriron Co., Inc., Dayton, Ohio. Bulletin on corrosion-resisting alloy steels, giving physical and chemical data and notes on machining, heat-treating, and welding.

CENTRIFUGAL BLOWERS AND COMPRESSORS. Roots-Connersville-Wilbraham, Connersville, Ind. Bulletin 170-B10, illustrating and describing different types of centrifugal blowers and compressors.

INDUSTRIAL TRUCKS. Lewis-Shepard Co., 125 Walnut St., Watertown Station, Boston, Mass. Circular 104, announcing a new single-lift truck known as "The Gold Flash."

WELDING EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Application Sheet No. 30 in a series on the elements of design, containing information on welded levers.

FLOOR PLATES. Inland Steel Co., First National Bank Bldg., Chicago, Ill. Folder describing Inland four-way floor plates, a steel flooring designed to prevent slipping.

DURIRON FANS. Duriron Co., Inc., Dayton, Ohio. Bulletin 166, containing information on the engineering and mechanical features of Duriron acid-resisting exhaust fans.

MOTORS. Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio. Bulletin 111, descriptive of Reliance Type AA squirrel-cage induction motors.

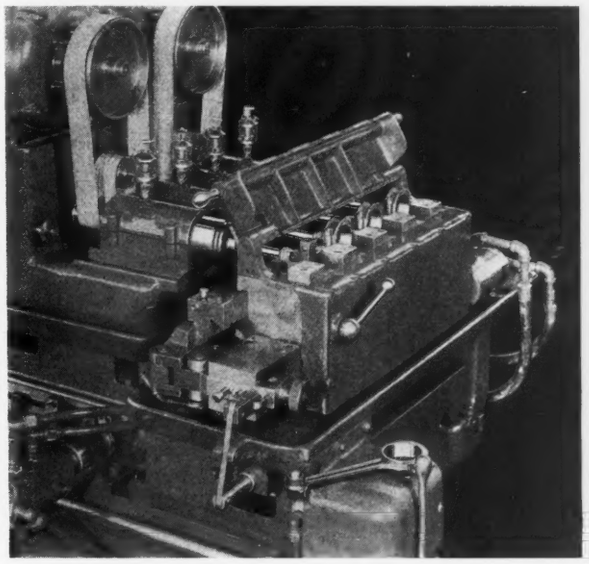
CRANES. Bucyrus-Erie Co., South Milwaukee, Wis. Bulletin L-4, illustrating and describing the many uses of a utility crane known as the "Loadmaster."

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-1607, illustrating and describing direct-current generators and exciters.

END-MILLS. Weldon Tool Co., Cleveland, Ohio. Catalogue 6, illustrating and describing regular and special types of "Wel-Don" end-mills.

Shop Equipment News

Machine Tools, Machine Parts, Unit Mechanisms and Material-Handling Appliances Recently Placed on the Market



Ex-Cell-O Precision Grinding and Boring Machines

Internal grinding spindles and suitable work-holding fixtures substituted for the boring units and fixtures of a precision boring machine built by the Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich., have converted the machine into high-production grinding equipment. The machine has been equipped in this manner for grinding relief at opposite points in the large bearing of automobile connecting-rods. Two banks of four grinding spindles are mounted on the ends of the unit base, as illustrated in Fig. 1, this base being mounted, in turn, on the fixture table. Four electric motors above and between the two banks of spindles drive two spindles each.

At the ends of the machine there are hydraulic fixtures that hold four connecting-rods apiece during the grinding operation.

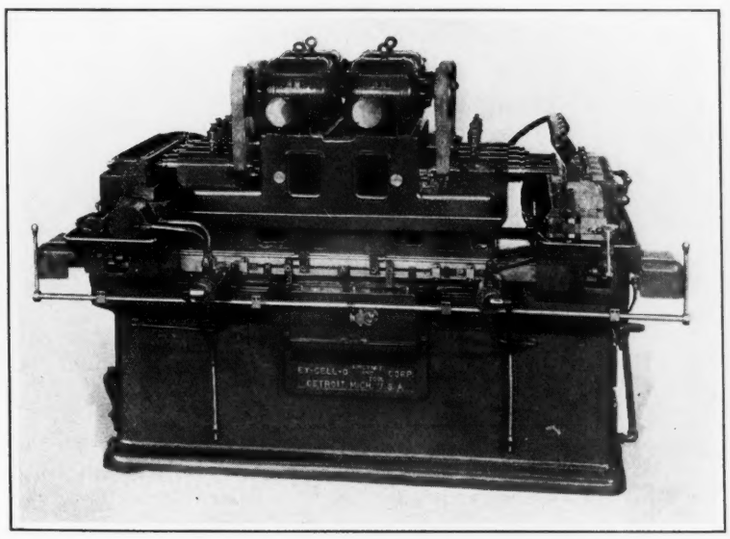


Fig. 1. Ex-Cell-O Special Grinding Machine Equipped with Eight Spindles

These fixtures are indexed from side to side hydraulically for grinding the relief in the bearings 180 degrees apart. The length of the indexing stroke is adjustable by turning a hand-knob at the side of each fixture. The heading illustration shows one of the fixtures open, with three connecting-rods in position.

A rotary valve controls the operating cycle of each fixture. By adjusting a differential sliding dog at the corresponding end of the table, the rotary valve will make the table take the number of strokes required for grinding the relief on one side of the rod bearing. The fixture then indexes for grinding the opposite side of the bearing. When the operation is completed, the table returns to the center of the machine and stops. To start the table in the opposite direction, the operator must pull the control lever which extends the full length of the machine. This insures that finished rods will be replaced with new rods before the machine is started up again. Automatic dressing of each wheel is provided for.

A precision boring machine of improved design, which the same concern has recently developed to replace the Style 216 machine described in November, 1930, MACHINERY, is shown in Fig. 2.

The over-all height of this new Style 216-A machine is 5 inches less than that of the previous machine. This brings the center distance of the individual boring units 42 inches above the floor line, and makes it easier for the operator to load and unload the work-holding fixture. The over-all length of the base has been increased 4 inches, to 74 inches; the width, however, remains the same as before, 23 inches. The base construction has been altered so as to prevent the accumulation of chips, dirt, and water.

Forced-feed lubrication is provided for the vee and flat ways of the table which support the work-holding fixture. The oil is fed in slowly at one end of the table ways and permitted to drain out at the opposite end.

The bridges are now mounted on two flat ways of the base. Slots in the base provide for attaching the bridges by means of T-bolts. In addition, hook bolts are used for drawing the bottom of each bridge against a scraped edge of the base. With these provisions, precise location of the bridges can be obtained.

The bracket that supports each boring unit has also been redesigned. The mounting lugs have been eliminated to give a neater appearance, and the brackets are mounted on the bridges by means of T-bolts which enter slots running across the top of the bridges. Two opposed micrometer screws provide for lining up each boring unit accurately in the horizontal plane.

The hydraulic cylinder which operates each boring unit brake is now located on the back end of the bridge directly below the individual brakes. All hydraulic connections to this cylinder are piped inside the bridge. The driving motor and coolant and oil pumps are located as before.

A valve for controlling the cutting coolant is mounted on the back of the base. This valve is actuated by an adjustable dog as the table passes back and forth, the coolant being turned on as the boring tools enter the work and turned off as they leave it. Thus the coolant is shut off during the table travel, with the result that the operator reloads a dry fixture.

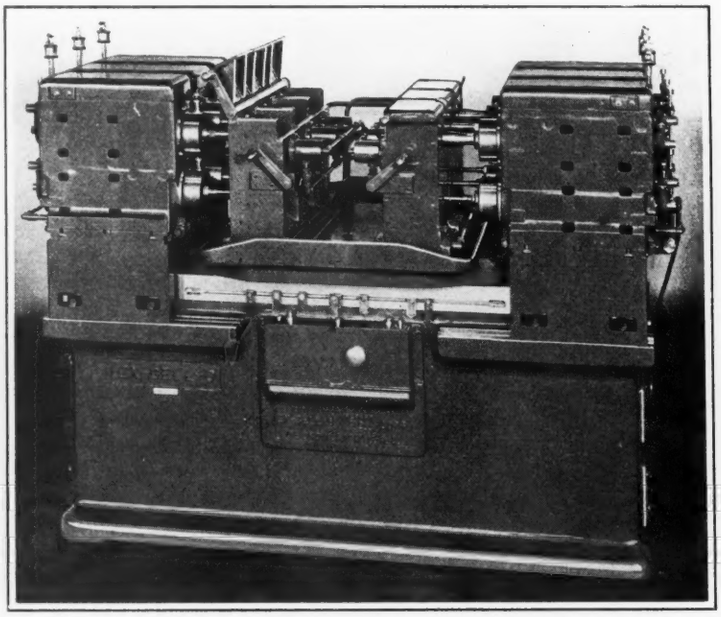


Fig. 2. Ex-Cell-O Precision Boring Machine of Improved Design which Replaces a Previous Model

Paint for Metal Surfaces

Prevention of electrolysis and corrosion are the principal advantages claimed for "Mabelite," a paint for metal surfaces which is being introduced on the market by the Eastern Mabelite Corporation, 225 Mercer St., New York City. The pigment is a finely ground natural ore found in one of the oldest geological formations in North America. This ore is free from acid and alkali, and being completely oxidized, it is inert and chemically stable.

The paint is said to be especially suitable for protecting metal surfaces subject to abrasion, rust, heat, oils, alkalies, salt water, and acids. At present, it is available in a brown color. When other colors are desired on machinery, Mabelite may be used for prime coats.

Morton Flash-Trimming Machine

The flash produced in butt-welding or flash-welding tanks and sheets can be quickly removed with a high-duty draw-cut machine recently built by the Morton Mfg. Co., Broadway and Hoyt St., Muskegon Heights, Mich. Two rams remove the flash from both sides of the work at the same time. The upper ram is carried in a guide-way which is movable vertically and forms a base for attaching the upper clamping jaw. The vertical movement of this guide-way is accomplished by means of air cylinders and levers that give sufficient pressure for straightening and clamping the work. The arrangement automatically compensates for any variation in the thickness of the stock.

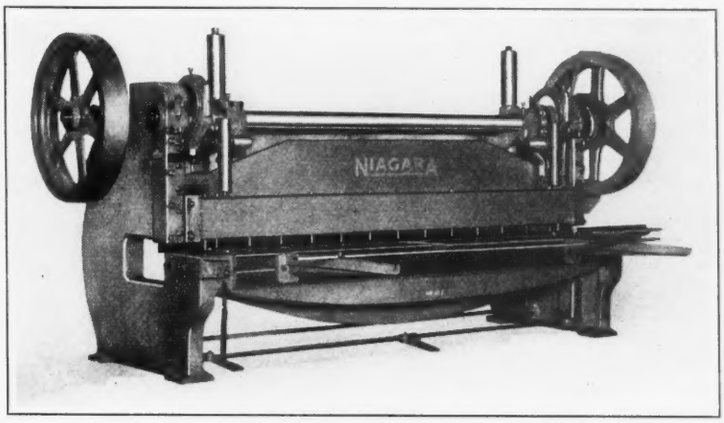
The rams are reciprocated by means of reversing clutches, so controlled that the machine makes one cycle and stops. The lower ram is carried in a solid guide-way, and it is so constructed that

all trimmings removed from the inside of drums drop through openings and are carried either forward or to the back. Means are provided for rigidly locking both the upper and lower housings while cuts are being taken.

The rams carry a multiple number of cutting tools which are readily adjustable for height. It has also been found practical to use straightening rolls preceding the cutting tools to help remove warpage caused by welding and handling. The length of stroke is adjustable up to 40 inches by means of movable tappets on a disk at the side of the machine.

The rams reverse automatically at the inner end of the stroke, the upper ram rising a distance of 2 inches before the reversal takes place. This enables the work to be removed easily while the rams are returning to their outer positions, a feature which saves considerable time.

Machines of this design are available in several sizes. The machine illustrated occupies an actual floor space of 3 by 14 feet and requires an operating floor space of 15 by 14 feet. Although this machine has a direct-coupled motor drive, other drives can be provided to suit requirements.



Niagara Power Squaring Shear of Structural-steel and Cast Construction

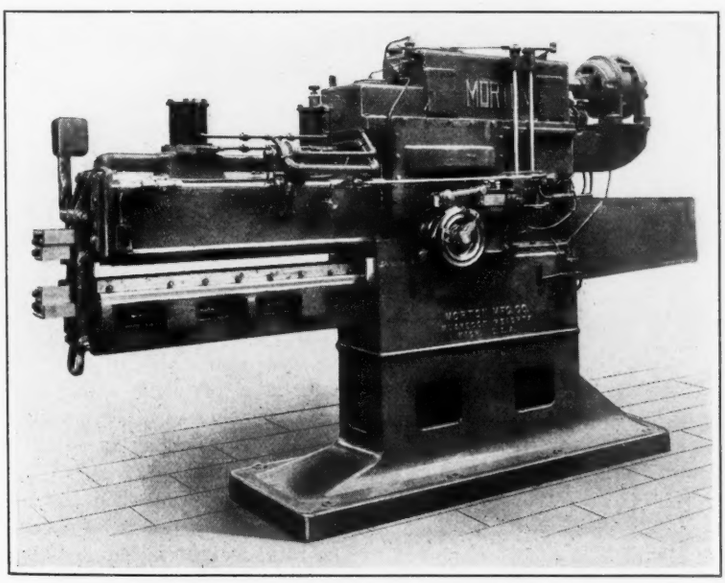
Niagara Power Squaring Shear

Smooth accurate operation and lighter reciprocating parts are the principal advantages of a new power squaring shear of structural-steel and cast construction which has been brought out by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. The combination of structural steel and cast members was adopted with a view to obtaining rigidity and lightness.

The housings and bed are semi-steel castings, while the hold-down, cross-head and transverse bar are made of steel. The cross-head, which is of welded construction consists of a vertical and a horizontal member tied together with triangular web sections. The heavy truss bar promotes rigidity and provides a center adjustment. Large springs enclosed in cylinders counterbalance the cross-head. This arrangement facilitates the functioning of the clutch and results in an even application of power, thus reducing strain on the wearing parts.

The shear has capacity for cutting plates up to 1/4 inch thick by 10 feet long. It is available with either a 1- or an 18-inch gap in the housings. An individual spring foot hold-down is provided, which insures even pressure on the plate being sheared, in spite of variations in the thickness of the metal. It is possible to cut simultaneously 1/4- and 1/16-inch sheets at opposite ends of the shear. Heavy and light sheets can be cut immediately after each other without any adjustment. The gears, or clutch wheel and pinion, have their teeth generated by a hob.

A full set of front, back, bevel, and side gages is supplied as standard equipment. In addition, there is a slitting gage for the 18-inch gap shear. The back gage is self-adjusting to 1/64 inch and can be instantly locked in the desired position.



Morton Draw-cut Machine with Two Rams for Simultaneously Removing Flash from Both Sides of Welded Tanks and Sheets

Toledo Double-Crank Press with Automatic Feed

Eight operations required to produce conical-shaped shells about 4 1/4 inches in diameter by 2 inches high are performed successively by the double-crank press here illustrated, as the pieces progress automatically across the dies. With thirty pieces completed per minute, this means the actual performance of 240 operations per minute. The shells are made of No. 24 U. S. gage stainless steel. The finished piece has a number of holes and bosses, as well as a flange.

The main feature of the press, which was built by the Toledo Machine & Tool Co., Toledo, Ohio, is the automatic feeding mechanism, which entirely eliminates intermediate handling between operations. The blanks, which have been cut previously to a diameter of 6 1/4 inches, are stacked in the large feed-tube seen at the left of the dies in Fig. 1. To start the operation of the machine, the hand-lever at the extreme right is thrown in. This hand-lever operates an improved multiple-disk friction clutch and a brake, which gives the operator absolute control of the machine and of the feeding mechanism at all times during its continuous operation.

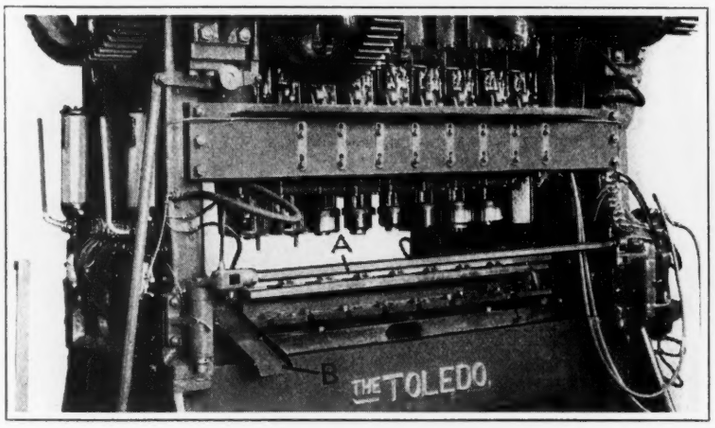


Fig. 2. The Punches, Automatic Feed, and Discharge Chute, as Seen from the Rear of the Machine

With the clutch engaged, the feeding mechanism pushes the blanks successively into the first-operation forming die. The shell produced in the first operation is ejected from the die by a positive knock-out in the punch and a cam-actuated knock-out in the bed. The shell is then caught by the fingers of the so-called "cut-and-carry" feed indicated at *A*, Fig. 2, which carries it successively under the various punches until the shell has been finally completed and is discharged into chute *B*.

This press is also adapted to produce a large variety of similar work, such as wheel-hub covers, reflectors, lamp and lantern bodies, milk separator shells, and large oil-can tops. It is of the double-crank type, with twin gears mounted on the crankshaft. Each of the eight punch slides is individually adjustable and is counterbalanced by a pair of air cylinders that insures smooth running. In addition to the cam-actuated knock-out in the bed, there is a pressure attachment for operating the draw-ring. Constant lubrication is supplied by a special system.

The distance between the uprights of the press is 84 inches. The total weight is about 45,000 pounds. Power for driving the press is supplied by a 15-horsepower direct-geared motor.

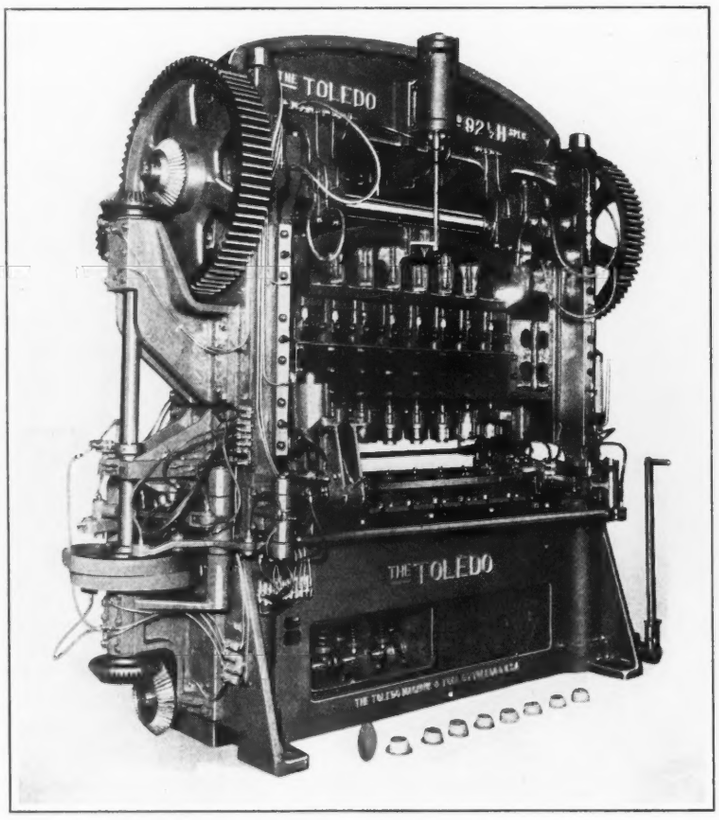
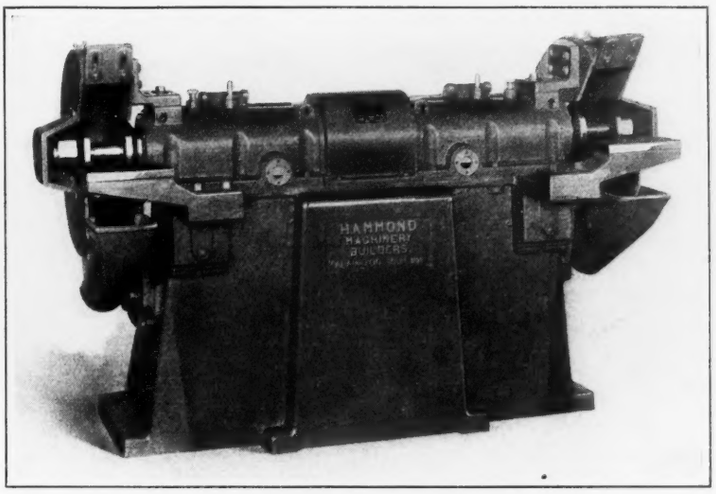


Fig. 1. Toledo Press with Special Feed that Automatically Carries Conical-shaped Shells through Eight Operations



Hammond Snagging Grinder with Individual Motor Drives to the Two Spindles

High-Speed Grinder with Independent Spindles

Two spindles that operate entirely independently of each other are a feature of a high-speed snagging grinder recently brought out by the Hammond Machinery Builders, Inc., Kalamazoo, Mich. Either Bakelite- or rubber-bonded wheels can be operated on this machine at a surface speed of 9000 feet per minute, as well as vitrified wheels at the usual rate of 6000 surface feet per minute.

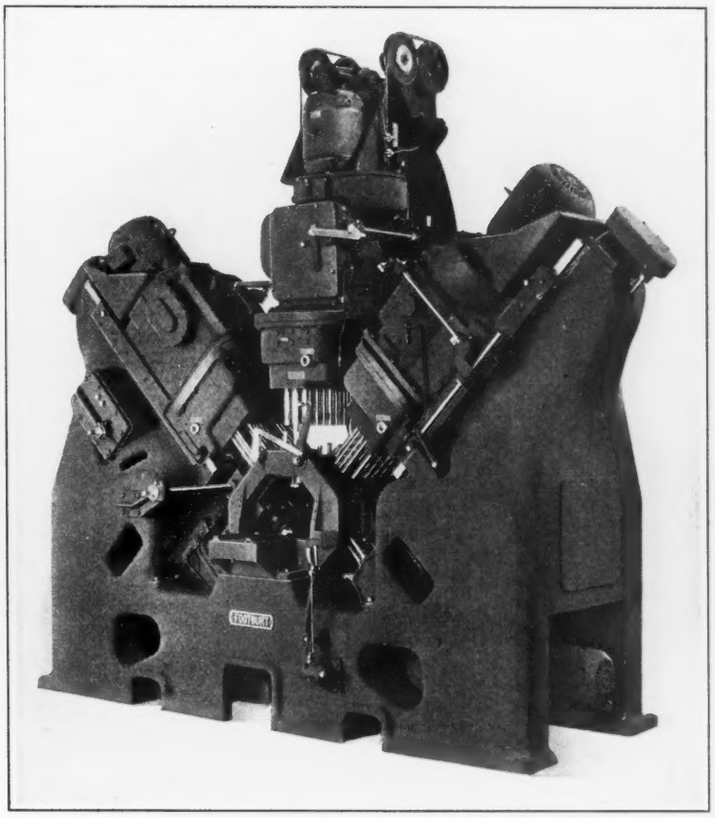
Each of the spindles is provided with its own motor and with separate multiple V-belts for transmitting power from the motor to the spindle. There are also individual automatic motor starters and separate spindle locks.

When the machine is equipped with the Hammond variable-speed pulley, a constant peripheral speed can be maintained as the wheels wear from their largest diameter to the scrap size. When this pulley is furnished, the machine is also provided with a safety device that prevents operation of the large wheels at a high spindle speed. The motor is totally enclosed, fan-cooled, and is mounted on a screw-feed bracket that provides an adjustment for the multiple V-belts. The machine illustrated is equipped with a cascade oiling system, which insures continuous passage of clean oil through the bearings under pressure. This equipment, however, is not standard.

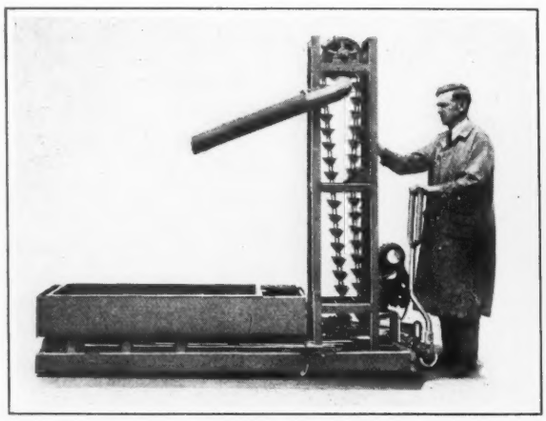
Footburt Five-Way Drilling Machine

A multiple-spindle drilling machine with heads that operate in five different directions was recently built by the Foote-Burt Co., Cleveland, Ohio, for drilling a V-type automobile cylinder block. As seen in the illustration, this machine has one vertical head, two upper angular heads, and two lower angular heads. In all, there are ninety drill spindles.

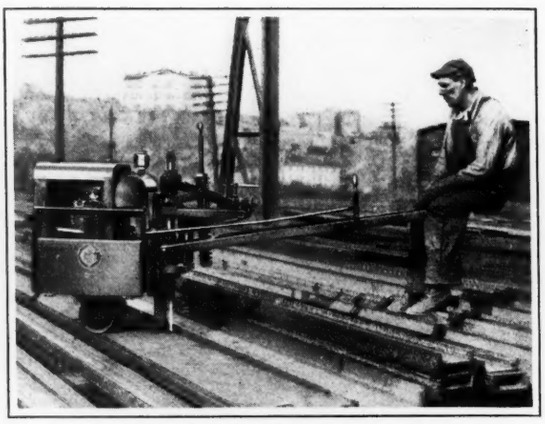
Each drilling unit is complete in itself, having an individual motor drive. The vertical head and the two upper angular heads are actuated by 14-inch drum-type cams, and the lower angular heads, which have a smaller number of spindles, are actuated by 10-inch drum cams. All the units are driven by standard foot-mounted ball-bearing motors, which are interchangeable on the vertical, horizontal, and angular



Footburt Five-way Multiple-spindle Drilling Machine Designed for V-type Automobile Cylinder Blocks



"Speed-loader" which Facilitates the Operation of Burnishing Barrels



Typical Application of the Gasoline-driven "Togglebug" Drill

ways. All the heads and cam units have individual lubricating systems with sight-feed gages.

The operation of the machine is simple. A throw-in lever operates all the drilling units and a new mechanism has been developed which makes this lever work very easily. A single operation of a lever on the fixture clamps and locates the cylinder block and also moves the guide bushings close to the work. The throw-in lever starts all units operating simultaneously. When the cycles are completed, the units return to their starting points and remain there until the machine has been reloaded and the throw-in lever again operated. Each head is individually adjustable on its ways to compensate for grinding of the drills.

Although the cam units on this machine have 10- and 14-inch cams, units with 6- and 16-inch cams can also be furnished. This provides a wide range of sizes to take care of various capacity requirements.

Abbott Burnishing-Barrel Loader

A "Speed-loader," designed to eliminate hand shoveling and wasted time in loading and unloading burnishing barrels, is shown in the accompanying illustration. This equipment was designed by William Ross Hartley, of New Haven, Conn., and is being manufactured and sold under license in the barrel burnishing field by the Abbott Ball Co., Hartford, Conn.

The "Speed-loader" consists primarily of a steel tower and a base that is mounted on three roller-bearing casters. In use, the loader is rolled into position, with the base extending under the burnishing barrel. The contents of the barrel are then emptied into a separating tray which rests in a hopper mounted on the base. The upper side edges of this screen-bottomed tray are flanged to rest on steel rollers mounted on the hopper. This permits easy riddling of the tray and its contents, the burnished articles remaining on the tray while the burnishing materials drop through to the hopper. All compound or water drains off the burnishing balls through a screen in the hopper.

Reloading of a burnishing barrel can be started while the previous load is being riddled. The return of the burnishing materials to the barrel is effected by means of an endless chain-and-bucket conveyor system. The malleable-iron conveyor buckets carry the burnishing materials to the chute at the top of the tower, from which they are discharged into the burnishing barrel. Steel gates in the hopper prevent overloading of the conveyor buckets.

Gasoline-Driven "Togglebug" Drill

A "Togglebug" portable drill driven by a gasoline engine so that it can be used anywhere in the field or shop is being introduced to the trade by the Guibert Steel Co., 1716 Youghiogheny Ave., Pittsburgh, Pa. This equipment, except for the six-horsepower gasoline engine, is similar to the electrically driven "Togglebug" drill described in July, 1930, MACHINERY, page 912.

Holes can be drilled, reamed, or countersunk in the heaviest plates and sections with this equipment. It will drill holes up to 1 1/2 inches through 12 inches of solid metal. Spindle speeds from 250 to 600 revolutions per minute are available. By sitting or leaning on the rear of the five-foot handle, the operator can exert a heavy pressure on the drill point. The machine is so balanced that it can be moved with one hand on its two rollers, which are equipped with roller bearings.

Micrometer Calipers with Tungsten-Carbide Spindle and Anvil Ends

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently included in its line of 1-inch micrometer calipers sixteen different styles having the ends of the

spindle and anvil faced with tungsten carbide. These micrometer calipers are particularly suited for use where micrometers are subjected to unusual wear. They are not carried in stock, but can be furnished at short notice.

Porter-Cable "Super Carbo-Lathe"

A "Super Carbo-Lathe" has been brought out by the Porter-Cable Machine Co., Syracuse, N. Y., that differs substantially in design from the original machine described in October, 1929, MACHINERY, page 101. The weight of the new machine has been made about 250 pounds greater, in order to increase the strength and rigidity. The bed and headstock alone are about 100 pounds heavier. The tailstock is also heavier, and is of a two-piece construction. An adjusting screw at the back permits the maintenance of accurate alignment between the headstock and tailstock centers. The toolpost is of a new design.

The spindle pick-off gears have been widened to 1 3/4 inches, increasing their strength about 40 per cent. Two ratios are now available in the worm-gear drive to the spindle—3 1/2 to 1 and 2 to 1. With the motor running at 1800 revolutions per minute, the low-geared head gives spindle speeds of from 95 to 1130 revolutions per minute and feeds ranging from 0.005 to 0.030 inch, while the high-geared head gives spindle speeds of from 170 to 2000 revolutions per minute and feeds from 0.003 to 0.025 inch. Variable-speed motors can be used to obtain an even wider speed range.

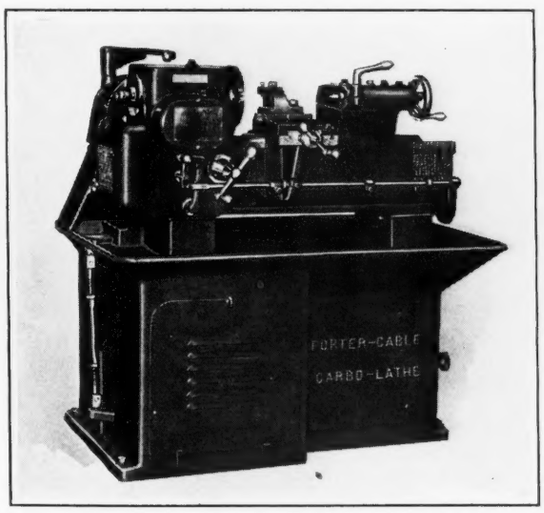
The drive from the motor is through four V-belts, instead of through a flat belt as in the previous design. The motor is mounted in the left-hand end of the base on a hinged plate. This plate is equipped with a turnbuckle adjustment for obtaining the desired belt tension. Alternating-current motors up to 10 horsepower or direct-current motors up to 7 1/2 horsepower can be installed.

Changes have also been made in the taper and facing attachments, an angular facing attachment now being available. On the carriage of the taper attachment, dual springs with an adjustable tension are used for holding the slide against the taper wedge. This prevents the tools from hogging into the work under heavy cuts. Special-form wedges can be used for turning irregular shapes. The improved facing attachment can be mounted on the back ways of the bed. It is driven from a rack in the bed. The feed pick-off gears are underneath the attachment. The angular facing attachment is similar to the regular facing attachment, with the exception that the cross-slide is mounted on a compound rest and can be swiveled through 180 degrees.

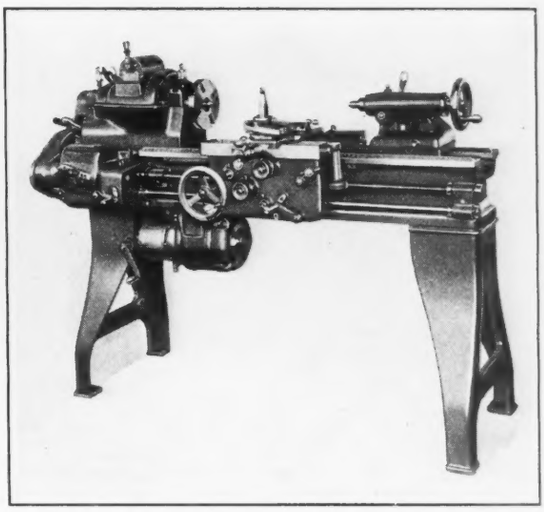
Rockford Lathes with Westinghouse-Wise Drive

The "Economy" lathes manufactured by the Rockford Machine Tool Co., Rockford, Ill., are now available with a built-in Westinghouse-Wise four-speed motor drive and controller as standard equipment. To select the different spindle speeds, it is merely necessary to turn a crank without stopping the motor. The transmission cushions the starting of the lathe and protects the roller-chain drive from overloads. Starting, stopping, and reversing of the spindle are effected through the controller. Back-gears double the speed range.

Thirty-two thread-leads or feeds are obtainable by shifting



Carbo-Lathe of Heavier Design Brought out by the Porter-Cable Machine Co.



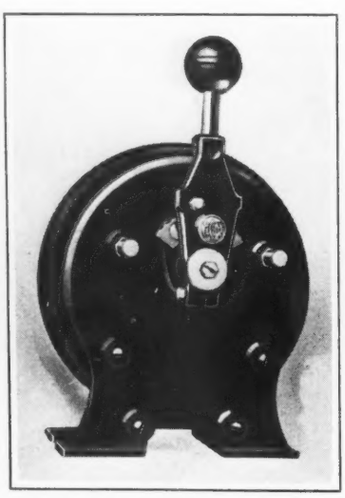
"Economy" Lathe Equipped with a Westinghouse-Wise Multi-speed Motor Drive

levers, while additional and special leads or feeds can be secured by changing quadrant gears. A thread-cutting dial is standard equipment. The lead-screw is made with a continuous thread, there being no spline. An interlocking safety clutch is provided for the feed-shaft.

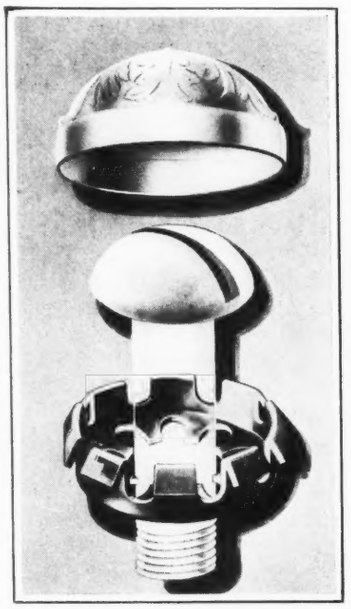
These lathes are built in three sizes having rated swings of 13 1/6, 14 5/8, and 17 3/4 inches. The capacities of the Westinghouse-Wise motors for these machines are 3/4, 1, and 1 1/2 horsepower, respectively.

Master Switch

A master switch for regulating the control circuits of a magnetic controller has been added to the line of electrical equipment made by the Electric Controller & Mfg. Co., 2696 E. 79th St., Cleveland, Ohio. This switch, which is designated the Type NX, is designed for use where a maximum of three points of speed control in either direction is required. It is particularly applicable to small hoists equipped with the Wright dynamic lowering circuit magnetic controller, as well as to roller tables, steel mill drives, and the bridges and trolleys of small cranes. The use of ball bearings insures smooth operation.



Master Switch Made by the Electric Controller & Mfg. Co.



"Lok-Crowner"—a Combined Lock Washer and Bolt- or Screw-head Cap

Lock Washer and Bolt-Head Cap

A device known as the "Lok-Crowner," which combines a lock washer and a metal cap that seals bolt heads, screw heads, or nuts, has been placed on the market by the Rawlplug Co., Inc., 98 Lafayette St., New York City. The lock washer is made of spring steel to fit all sizes of bolts and screws. It has a four-point locking arrangement and is of the shape illustrated.

Projecting prongs engage and securely hold the cap to the washer when the cap has been pushed into place. The cap can be furnished either plain or embossed with attractive or special designs. It covers the lock washer completely, as well as the bolt or screw head.

Oilite Self-Lubricating Bronze Bearings

Bronze bearings that lubricate themselves have been placed on the market for a variety of applications by the Amplex Mfg. Co., Division of the Chrysler Corporation, 7900 Jos. Campau Ave., Detroit, Mich. These Oilite bearings are made from pure virgin copper in the powdered form, to which tin and graphite are added. The copper is powdered so fine that all of it can be passed through a 100-mesh screen and a large part through a 300-mesh screen. The materials are weighed out according to formula and then briquetted under a pressure of 50,000 pounds per square inch. The briquette is given a heat-treatment which changes its characteristics and color, producing a tough and ductile bronze.

This bronze is porous enough to hold from 30 to 35 per cent of liquid by volume. The liquid may be anything from kerosene to "600W" oil. The porosity of an Oilite bushing can be demonstrated by holding a finger over one end, filling it with water and then applying pressure to the water by pushing the thumb into the open end of the bushing. Water and oil will immediately come through the wall of the bushing, as shown in the illustration. If a bushing is placed in a vise and squeezed, a thick coating of oil will cover the surface, and heat will produce the same effect. These bearings have been adopted as standard on Chrysler automobiles for the bushings of water pumps, steering gears, propeller shafts, etc.

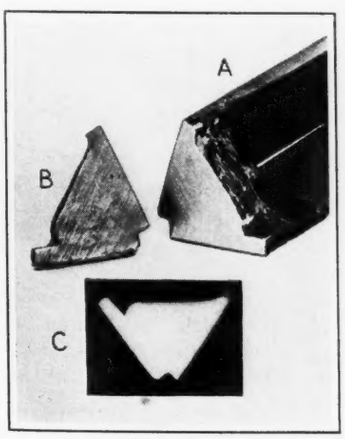
Forcing Oil through Oilite Bearing by Pressing on Water Within

Ryerson Stainless-Steel Welding Rod

A welding electrode just placed on the market by Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill., is applicable to Allegheny metal and other stainless steels in the 18-8 chrome-nickel group. This rod has a flux coating which produces a non-active gas that surrounds the hot metal. The gas prevents the oxygen of the air from attacking the metal and forming oxides. The slag on top of the weld acts as a protective agent when the metal cools.

An important advantage of the new rod is that it is unnecessary to remove the slag on one bead before the next bead is laid. This enables the operator to work fast, and at the same time secure good penetration. Tests show that the corrosion resistance of the deposited metal remains equal to that of the parent metal and leaves the weld soft enough for machining.

The illustration at *A* shows a V-type weld consisting of eight layers, placed one on top of the other without removing any slag. Section *B* was cut from the welded piece; it is 1/8 inch thick. The X-ray picture at *C* was taken of this section. It indicates a perfect bond between the welding rod and the work, there being no blow-holes or gas or slag pockets.



Stainless Steel Weld and X-ray of the Thin Section Cut from it

Electrode-holder Stand which Automatically Stops and Starts Welding Machines

"Power Saver" Electrode-Holder Stand

An electrode-holder stand that shuts down the welder one minute after the holder is placed on the stand and instantly starts the welder when the holder is removed has been designed by the Lincoln Electric Co., Cleveland, Ohio. It is claimed that the automatic start-and-stop feature of this stand effects a decided saving in power consumption, and on this account, the stand has been given the trade name of "Power Saver." It is intended to do away with the common practice of letting a welder run continuously, even though the operator may be welding intermittently.

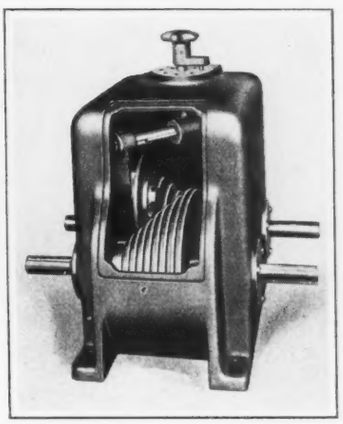
This stand can be used wherever the welding equipment is provided with an automatic motor starter having a two-wire pilot control. When the hook at the top of the stand is depressed by the weight of the electrode-holder, it actuates a special timing device which disconnects the welder from the power supply line at the end of one minute. When the weight of the holder is removed from the hook, the welder starts automatically.

General Multi-Speed Transmission

The General Radial Drill Co., 1765 Elmore St., Cincinnati, Ohio, has brought out a line of "Multi-Speed" change boxes which embody the Gibbs V-disk transmission. This transmission, as will be seen in the illustration, consists of a V-disk made of fabricated material and two grooved cones or sheaves made of steel. The composition disk runs as an idler between the driving and driven cones, the idler tending to pull between the cones because of the fact that the cone centers are fixed. This prevents any change in the position of the idler disk. A wedging action is produced which varies in direct proportion to the load carried.

Eight speed changes are available in the "Multi-Speed" boxes, and they may be obtained in ratios up to 9 to 1. Speed changes are easily made by means of the star knob on top of the unit.

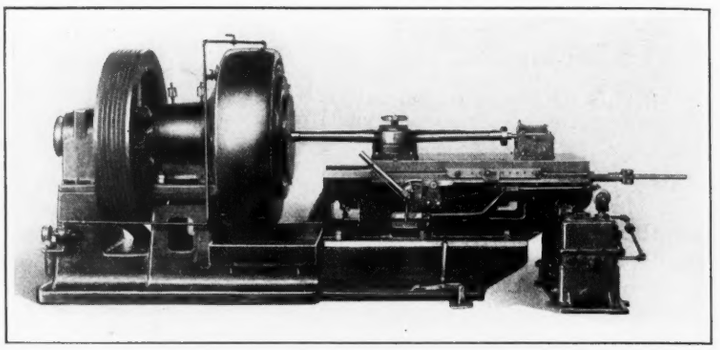
Lubricant can be supplied to the ball bearings of the cone shafts from the outside. These speed-change boxes are made in sizes from 3/4 to 10 horsepower.



"Multi-Speed" Box Embodying the Gibbs V-Disk Transmission

Langelier Swaging Machine with Hydraulic Feeding Mechanism

A semi-automatic hydraulic feeding mechanism is the principal feature of the Type J swaging machine recently built by the Langelier Mfg. Co., Providence, R. I., for reducing both ends of automobile rear-axle housings. This operation is performed after the housing has been formed and welded. It thickens the wall to compensate for the removal of metal in a subsequent turning operation and to increase the strength of the housing.



Langelier Swaging Machine Equipped with Hydraulic Feed for Handling Rear-axle Housings

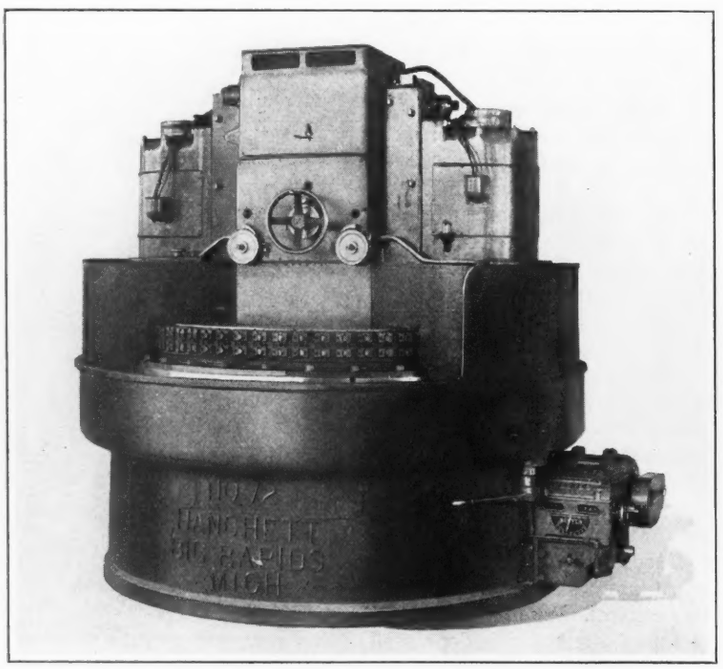
In the operation of this machine, the axle housing is loaded on the fixture and clamped by hand. An automatic air cylinder centralizes the work with the die. The operator then moves the hydraulic pump-control lever into the forward feed position, after which the cycle is performed automatically. The cycle consists of a quick advance of the work to the die, a swaging feed, and a rapid return.

The swaging head is of the two-die type. It is provided with a water jacket so that the machine can be used for hot or cold swaging. Power is transmitted to the machine from a motor through V-belts and grooved sheaves. The hydraulic feeding mechanism is operated by a variable-delivery, high-pressure motor-driven pump.

Lubrication of the head is insured by a pump driven from the spindle, which forces oil into the head after passing it through a filter. The oil returns by gravity to a reservoir cast in the base. This machine has an approximate weight of 9 tons.

Hanchett Rotary Surface Grinder

A rotary surface grinding machine with a large circular table that revolves in a horizontal plane about a central column has been developed by the Hanchett Mfg. Co., Big Rapids, Mich., for a wide variety of operations. The circular table is designed to hold numerous types of fixtures, including rotary magnetic chucks. Three built-in grinding-wheel heads permit roughing, semi-finishing, and finishing cuts to be taken without removing the work from the fixture. With this construction, it is claimed that high production can be obtained, while still maintaining close accuracy and a high degree of finish.



Hanchett Rotary Surface Grinder with Three Built-in Wheel-heads

The grinding-wheel heads are mounted on the central column, which makes the machine accessible from all sides. With the adjustment provided for the grinding-wheel heads, it is possible to align them accurately parallel with the plane in which the work-table travels. Also, the heads can be readily set to provide clearance on the back edge of the grinding wheels. A vertical feed of six inches is available for each head, and the height between a new grinding wheel and the table is 10 inches.

The grinding-wheel heads are automatically fed vertically to compensate for wear of the wheels. If desired, the automatic

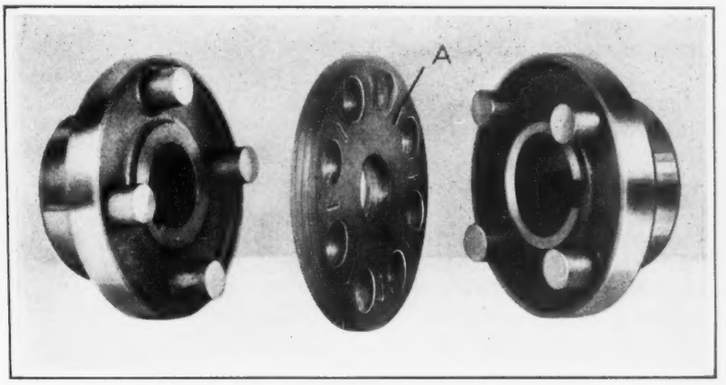
control can be omitted and a manual control provided. A device is furnished for dressing each wheel parallel with the plane of rotation.

The grinding wheels are 18 inches in diameter by 3 inches high, and different face widths can be supplied. Red Anchor cylinder wheels, cylinder wheels held in chucks, or segmental cylinders can be furnished. Each wheel is driven by a 15-horsepower motor at a surface speed of 5400 feet per minute. Lubrication of the grinding-wheel spindles is obtained by pumping oil from a tank in the bed to a reservoir at the extreme top of the machine. The oil drains from this reservoir to the top bearing of the grinding-wheel spindles and is piped from this point to the bottom bearing of the spindles.

The ring-type table is 72 inches in diameter by 16 inches wide. It is driven through helical and worm gearing, a variable-speed unit, and a three-horsepower motor. The table has a speed range of from 3/4 to 3 revolutions per minute. In the illustration, the table is shown equipped with a large circular fixture for handling tappet valves. The weight of the machine without any fixtures is 22,000 pounds.

Brown Buffer-Slot Couplings

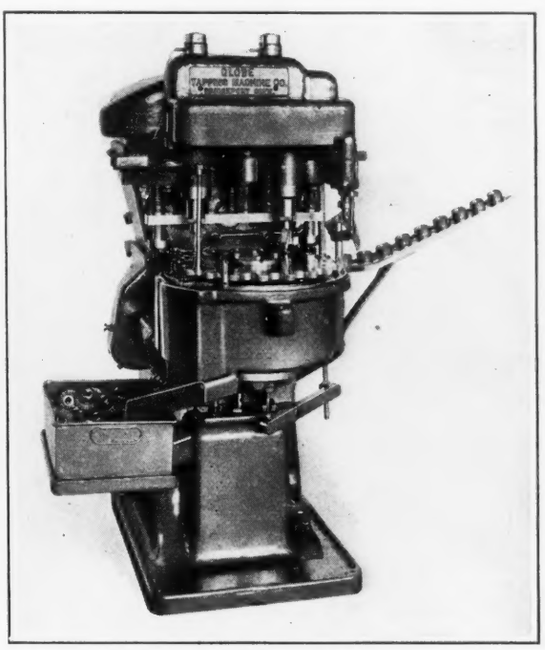
The principal feature of a new type of flexible coupling introduced on the market by the Brown Engineering Co., 123-127 N. Third St., Reading, Pa., is the provision of narrow radial slots in the leather disk that separates the driving and driven members of the coupling. Because of these slots, the new coupling has been given the trade name of "Buffer-Slot." By varying the length and width of the slots, one of which is indicated at *A* in the illustration, any amount of flexibility can be obtained.



Brown Buffer-Slot Coupling Designed to Compensate for Parallel and Angular Misalignment and to Absorb Shocks

The advantages claimed for this coupling are that angular or parallel misalignment can be corrected, as well as a combination of both; that load shocks and torsional vibration are absorbed; that free end-play is provided, permitting the use of the coupling with herringbone gears; and that only a slight pressure is imposed on the bearings.

In cases of parallel misalignment and load shocks, the buffer slots close entirely, while under conditions of angular misalignment, they close on one side only of the leather disk. When there is no misalignment and a full load is being transmitted, the slots are open.



Globe Automatically Operated Machine Equipped for Spot-facing Small Commutators

Globe Automatic Spot-Facing Machine

An automatic machine adapted for drilling, countersinking, spot-facing, and similar operations on many different types of work has been developed by the Globe Tapping Machine Co., 751 Central Ave., Bridgeport, Conn. The particular machine shown in the illustration is equipped with two heavy-duty spindles which carry spot-facing cutters for facing the protruding bushing of a small commutator. A roughing cut is taken with one spindle and a finishing cut with the other.

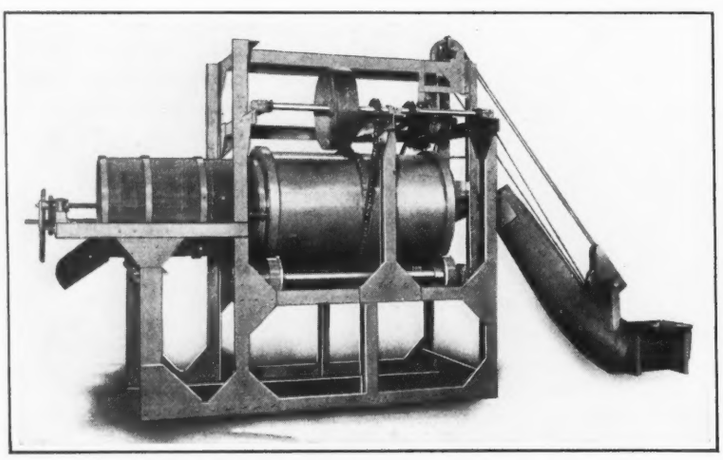
The shape of the commutator permits it to be held automatically during the facing operation without distortion. If the dial should fail to index properly, due to abnormal resistance, an automatic mechanical trip would prevent the head

from coming down, and thus eliminate any danger to the dial or cutters.

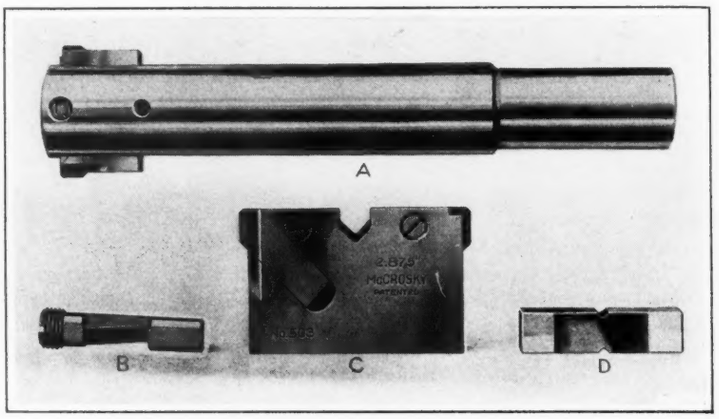
The production on this operation is twenty finished pieces per minute. One operator is able to load the chutes of several machines, as the parts are fed automatically into the dial from the chute. The ejection of the finished parts is also effected automatically. The machine is driven by a motor mounted in the base on a tilting plate that permits adjustment of the driving belt.

Ransohoff Tumbling Barrel

An "Ideal" sawdust tumbling barrel recently built by N. Ransohoff, Inc., Cincinnati, Ohio, equipped with a power loader, is shown in the accompanying illustration. The loading skip picks up the load from the floor level and feeds the charge into the tumbling drum. When the operation has been completed, the sawdust and parts are delivered to the rotary screen, which separates the tumbling material from the parts. The parts are then discharged from the screen at a convenient height for shop receptacles. A worm of forged machine steel within the tumbling barrel cleans the barrel thoroughly when the work is discharged and yet does not hurry the work along during the tumbling operation.



Ransohoff Tumbling Barrel Equipped with Power Loader



McCrosky Block-type Boring-bar and Disassembled Parts

McCrosky Block-Type Boring-Bars

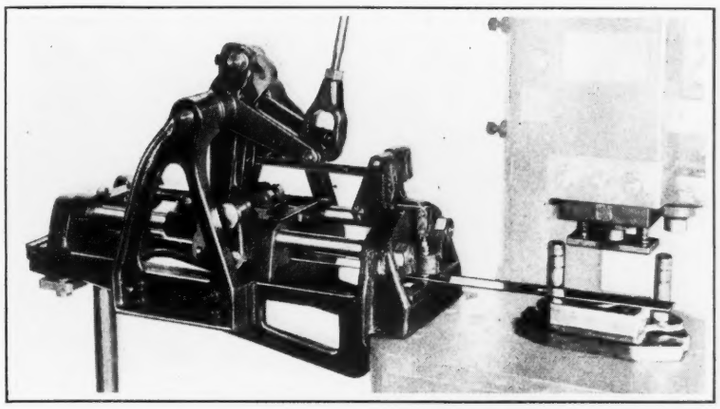
A new line of block-type boring-bars is being introduced on the market by the McCrosky Tool Corporation, Meadville, Pa. These bars have a key with a tapered vee that locates and locks the cutting block by engaging a vee in the front of the block. The illustration shows one of the keys at *B* and a cutting block at *C*.

By adjusting the position of the key in the bar, the block can either be locked rigidly or permitted to float. The design of the key enables the contacting faces on the vee to be altered in order to bring the block central in the bar in case the bar is sprung out of line while in use. The cutting thrust is not taken by the locating key, but by a hardened thrust block *D*, which is located between the cutting block and the rear of the slot in the bar. It is not necessary to remove the locating key from the bar in order to remove the cutting block, and the block can readily be reassembled.

Blades are locked in the cutting block by an adaptation of the pin-and-screw arrangement used in McCrosky multiple-blade reamers. The screw has a left-hand thread, and the end opposite the thread is piloted in the block. When the screw is tightened, the pin is forced into a groove in the blade and this draws the block and blade tightly together. The action of the lock is in the same direction as the cutting thrust. It also forces the blade against adjusting screws that enter the block from the rear end. The blades can be accurately adjusted to micrometer sizes.

The standard blades are made from high-speed steel, but Stellite blades and blades tipped with tungsten carbide or tantalum carbide can be furnished. There are five different series of standard blocks for bores from 1 1/4 to 12 inches. Each block can be furnished in three styles—roughing, finishing, and extended.

A grinding fixture has been developed that permits all regrinding of the blocks, including the grinding of eccentric relief, to be done without changing the position of the block.



Slide-feed Designed to Advance Stock to Punch Press Dies with a High Degree of Accuracy

U. S. Slide-Feed for Punch Presses

A sliding type of stock feed for punch presses has recently been developed by the U. S. Tool Company, Inc., Ampere, N. J., which is claimed to have an unusual degree of accuracy, resulting from the use of positive stops. The amount of stock advanced for each stroke of the press can be controlled so accurately that pilots are generally unnecessary on the punches of multiple-operation dies. Another advantage is the large amount of stock that can be advanced between the ram strokes.

This feed is based on principles incorporated in the U. S. multi-slide automatic cutting, forming, piercing, and embossing machine described in June, 1931, MACHINERY, page 803. It is intended to be applied to punch-press tables in the manner illustrated, a leg being furnished to support the outer end. A slide reciprocates between the stops. The stops are adjustable for accurately controlling the length of the slide movements down to thousandths of an inch. A clamp on the slide grips the stock securely each time that the slide is returned to its extreme left-hand position. This gripping action is maintained as the slide advances, until it comes in contact with the stop that governs the extreme right-hand position. In this way, the stock is pushed forward by the slide an amount equal to the movement of the slide.

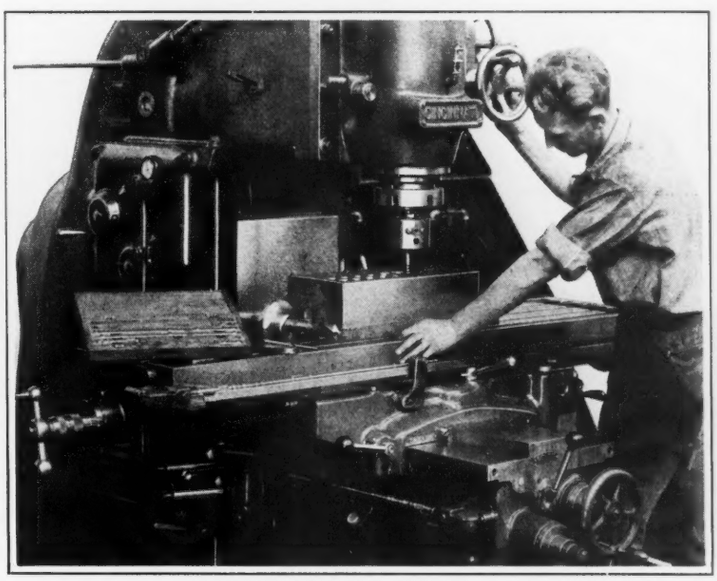
As soon as the forward movement of the slide stops, a plunger known as the "stock check" is automatically brought down to exert a heavy pressure on the stock at the front end of the stock-feed frame. The plunger holds the stock stationary as the clamp of the slide is released and the slide returns to its left-hand position. During this time, of course, the ram of the press descends for the operation and returns to the upper position.

All movements of the slide-feed are actuated by the overhead rod that connects it with the adjustable eccentric of the press. The slide movement and the stock advance between the strokes of the press ram can be adjusted any amount from 0 to 8 inches on the No. 1 slide-feed here illustrated. Stock up to 6 inches wide can be handled. Lubrication is provided by the Alemite system.

Precision Measuring Device for Milling Machines

A precision measuring device that increases the adaptability of Cincinnati milling machines for jig-boring and die-sinking has been designed by the Cincinnati Milling Machine Co., Cincinnati, Ohio. This device is also suitable for the boring of work in small or moderate lots when close limits are held on the spacing between holes. It is stated that the device makes possible the finish-boring of holes spaced within an accuracy of 0.0005 inch.

This equipment eliminates cut-and-try methods by providing a simple and fast means of mea-



Accurate Boring Operation in which Use is Made of a New Precision Measuring Device

suring center-to-center distances with precision. It consists of a dial indicator, a micrometer head, and a set of standard measuring rods for each movement of the machine—cross, longitudinal, and vertical. The dials are protected by covers. Brackets and a V-block hold the measuring rods and micrometer head. The measuring rods and micrometer head are placed between the adjustable stop and the dial indicator, as seen in the illustration at the front of the table and on the left-hand side of the knee.

In boring a series of holes along a casting such as illustrated, the work is so positioned on the machine table that the spindle lines up with the first hole. Sufficient measuring rods are then used to make the micrometer head and dial indicator on the front of the table read zero. To locate the work accurately for boring the next hole, the required number of measuring rods are removed to make up the even inches. Then, the micrometer head is adjusted to take care of the fractional part of an inch in the required center distance between the holes. The table is then moved horizontally until the dial indicator again registers zero.

Hills-McCanna Single-Line Multi-Feed Lubricating System

Light greases or heavy oils can be delivered to any number of points requiring regular lubrication by means of a single-line multi-feed system recently developed by the Hills-McCanna Co., 2349-2359 Nelson St., Chicago, Ill. The equipment is shown in the illustration. The main unit is placed in a convenient location and a single feeder line is taken from it to the farthest point requiring lubrication. Branch lines connect the main line to each bearing requiring lubrication. There is no return line to the main unit.

An independent mechanical measuring unit is provided at each bearing. A valve on this unit allows only the desired amount of grease or oil to be fed to the bearing, and when that amount has been delivered, the valve shuts off to prevent wasting the lubricant. Pressure is applied to the line only at the time that the various points are being lubricated. A positive pump supplies the pressure. Motor-driven mechanically operated or hand-operated equipment can be supplied suitable for a large variety of service.

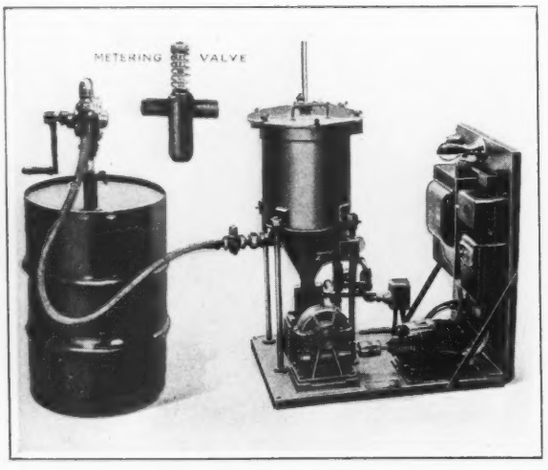
Lewis-Shepard Single-Motion Lift Truck

A "Gold Flash" single-motion lift truck equipped with a newly designed release check of high capacity for controlling the load in lowering is being introduced to the trade by the Lewis-Shepard Co., Watertown Station, Boston, Mass. Low head-room is another feature of this truck. It is made in various capacities up to 5000 pounds, with lifts of 1 5/8 and 2 1/4 inches. Widths of 17 1/2 and 24 inches are available.

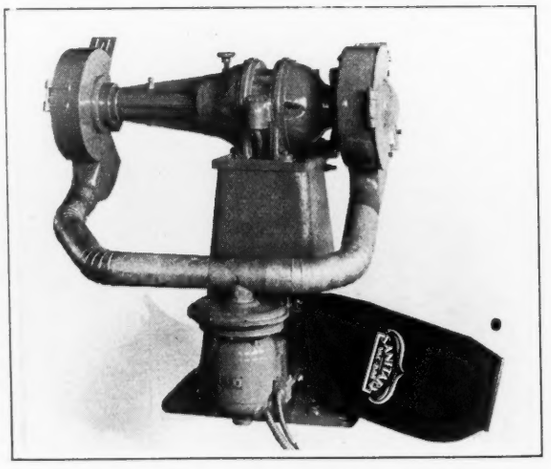
Exhaust Blower System for Grinding and Buffing Machines

The Standard Electrical Tool Co., 1938-46 W. Eighth St., Cincinnati, Ohio, has designed a motor-driven exhaust unit for application to the heavy-duty grinders and buffers built by this company. The illustration shows a combination grinding and buffing machine provided with this equipment.

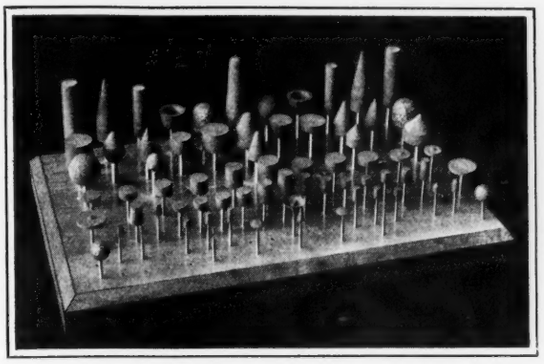
Both sides of the machine are fitted with hinged door guards that have exhaust outlets. These outlets are connected to the exhaust unit mounted on the back of the pedestal. This unit is driven by a 3/4-horsepower motor at a speed of 3600 revolutions per minute.



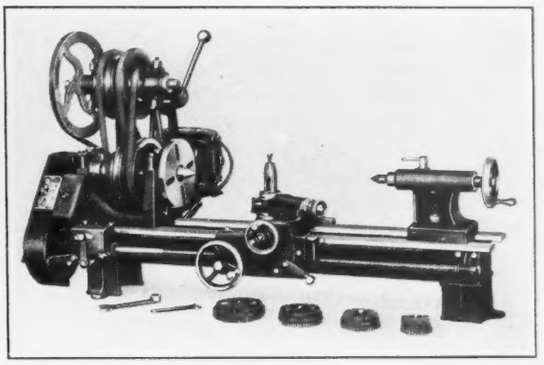
Equipment for Feeding Light Greases or Heavy Oils to Points Requiring Lubrication



Exhaust Blower System Mounted on Combination Grinding and Buffing Machine



Variety of Abrasive Pencils, Points, and Wheels Made by the Norton Co.



Screw-cutting Bench Lathe Manufactured by the Atlas Press Co.

Norton Mounted Abrasive Points and Wheels

More than one hundred different shapes are included in a line of mounted abrasive wheels, points, pencils, buttons, and other shapes being introduced on the market by the Norton Co., Worcester, Mass. The line ranges from tiny points 3/32 inch in diameter up to 1-inch wheels.

Most of these mounted abrasive products are made of 38 Alundum abrasive which was developed expressly for tool, die, and similar work. For the production grinding of small holes, the mounted wheels are made of regular Alundum abrasive, while for non-ferrous and non-metallic materials, there are Crystolon abrasive points and wheels.

The spindle of these products is made of special steel, copper- and nickel-plated. The tip is knurled and has a chisel end to insure permanent anchoring of the abrasive on the quill.

Atlas Screw-Cutting Bench Lathe

Right- and left-hand screw threads from 4 to 32 per inch can be cut on a bench lathe made by the Atlas Press Co., Kalamazoo, Mich. The change-gears for each thread lead can be quickly selected by referring to a chart on the gear housing. A thread dial is provided which can be locked in or out of mesh with the screw.

Another feature of this lathe is the V-belt drive. Power is furnished by a 1/4- or 1/3-horsepower motor mounted at the back of the machine. Six spindle speeds ranging from 47 to 600 revolutions per minute are quickly available. The speeds are changed with the power shut off. The different speeds are obtained through a countershaft that is mounted directly above the headstock with a view to obtaining a self-contained unit that occupies minimum bench space.

The carriage can be locked in position for accurate facing. An automatic longitudinal feed is obtained by engaging half-nuts with the feed-screw. The tailstock can be set over for taper turning.

The swing over the bed of this lathe is 9 inches, and over the carriage, 6 inches. The capacity between centers is 18 inches, and the bed length is 36 inches. Various attachments can be supplied.

Herculoy—A New Silicon-Bronze

A patented and trademarked silicon-bronze called "Herculoy" has just been placed on the market by Revere Copper and Brass Incorporated, 230 Park Ave., New York City. This alloy possesses the advantages of strength and corrosion-resistance that characterize the silicon-bronzes, and in addition, has special properties that render it more readily adaptable to fabricating operations than is usual with silicon-bronzes. Its strength is comparable to that of low and medium carbon steel and its corrosion-resistance qualities approximate those of pure copper. A feature that differentiates this alloy from similar alloys is the inclusion of tin in its composition.

Herculoy possesses a single-phase structure similar to that of Alpha brass, which makes it possible to obtain a wide range of physical properties through correct annealing. The tensile strength can be varied from 68,000 pounds per square inch for hot-rolled sheets up to 120,000 pounds per square inch for cold-drawn rods. The elongation in 2 inches ranges from 51 per cent in the case of hot-rolled sheets down to 2 per cent in the case of cold-drawn rods.

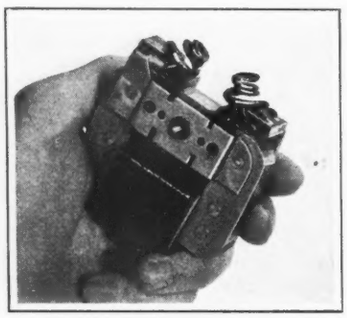
Because of the fact that the new alloy is non-rusting and non-magnetic, it has the ability to withstand extreme daily and seasonal temperature changes when overstressed or when exposed to weather, fog, gases, etc. In its wrought forms, the alloy is said to be so ductile that it can be stressed to the yield point without danger. It also has a high resistance to shock and is easily hot-forged.

Herculoy is available at the present time in the form of sheets, plates, rolls, strips, rods, bars, shafting, die-pressed or hammered forgings, rivets, welding rods, and ingots for sand-castings. Some of the more

common applications of the alloy include bolts, nuts, screw machine products, turnbuckles, lag screws, electric transmission-line hardware, tanks, and parts that are exposed to sea water.

Barcol Reversible Midget Motor

The fractional-horsepower, single-phase, induction motor of the shaded pole type made by the Barber-Colman Co., Rockford, Ill., is now available in a reversible model. Uni-directional models were described in December, 1931, MACHINERY, page 313,



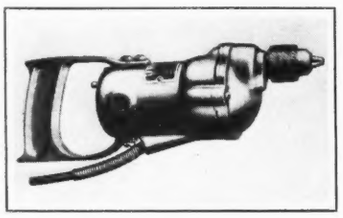
Reversible Motor Smaller than the Palm of a Hand

and in May, 1932, MACHINERY, page 718.

The reversing model employs shading coils in place of the shading rings of the previous models. The motor is connected with the current in the main field coil all the time, no rotation being produced until a current is sent through one or the other of the two sets of shading coils. The direction of rotation depends upon which set of shading coils is energized.

One-Quarter Inch Midget Drill

The latest addition to the line of electrically driven tools made by the United States Electrical Tool Co., 2477 W. Sixth St., Cincinnati, Ohio, is a 1/4-inch Midget drill. This drill weighs only 3 1/2 pounds and is only 8 inches long without the handle.



Light-duty Drill Designed for Use in Close Quarters

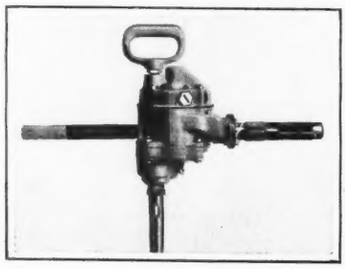
The handle is quickly removable to permit using the drill in close quarters.

The body of the drill is made of aluminum and the gears of hardened chrome-manganese steel. They are of the double-reduction type and operate in a grease-tight compartment. A 1/4-inch screw-back chuck and a universal motor are provided.

Reversible and Non-Reversible Pneumatic Drills

The Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, has recently added to its line of Power Vane tools No. 315 reversible and non-reversible rotary drills. The reversible drill is shown in the illustration. This type is recommended by the manufacturer for drilling, reaming, flue-rolling, and tapping operations, particularly when they must be performed in close quarters. The non-reversible type is intended for general-purpose drilling and reaming, particularly in close quarters.

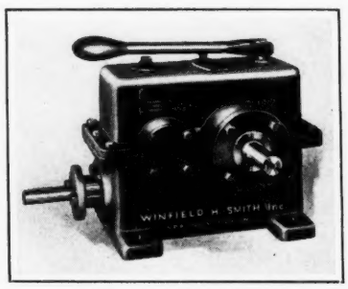
The throttle handle of the reversible type is equipped with a safety lock which positively prevents a change in the direction of rotation unless the lock is released by the operator. Low weight per horsepower is one of the principal features claimed for both types. They are made in several sizes having a drilling capacity of from 1/2 to 7/8 inch and a reaming capacity of from 3/8 to 1/2 inch. The reversible type weighs 15 pounds, and the non-reversible, 14 1/2 pounds.



"Power Vane" Reversible Pneumatic Drill

Two-Speed Reducer

A two-speed gear reducer designed for conveyor and other applications requiring a change in speed has been developed by



Reducer Unit which can Deliver Either of Two Speeds

Winfield H. Smith, Inc., 116 Eaton St., Springville, Erie Co., N. Y. Reduction ratios ranging from 4 to 1 up to 150 to 1 can be supplied. An important feature of this speed reducer is the provision of a neutral position that permits the mechanism operated by the slow-speed shaft to be stopped without shutting off the delivery of power to the reduction unit.

Changes of speed or a change to the neutral position are made by merely shifting the lever on top of the unit. This can be done while the unit is operating under full load.

Red-E-Quick Die-Head

An automatic self-opening and quick-setting die-head known as the "Red-E-Quick" has been developed by the American Die & Tool Co., Reading, Pa., for use on the Red-E-Hall portable pipe

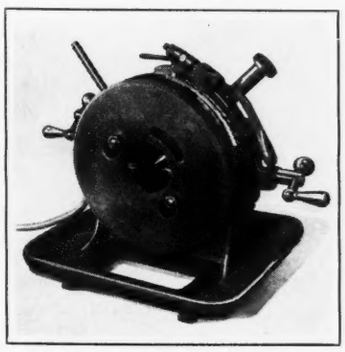
and bolt threading machine. This machine was formerly built by Hall-Will, Inc., Erie, Pa., who recently sold the manufacturing rights to the American Die & Tool Co.

The new die-head requires only two sets of dies for threading all sizes of pipe from 1/2 to 2 inches, inclusive. One of these sets is for 1/2- and 3/4-inch pipe, while the other set handles the remaining sizes.

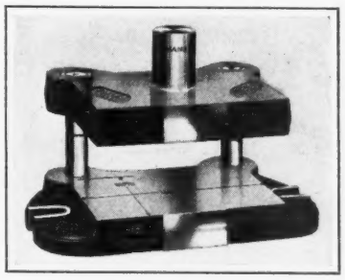
The dies are easily and quickly positioned by means of a cam ring which is provided with an accurately notched segment. Each notch of this segment is marked for a given setting of the dies. A pawl engages the notches as the cam ring is rotated. When the pawl engages any notch, it locks the dies securely for cutting threads of the pipe size marked beside that notch.

When a standard length of thread is to be cut, a spring plunger is depressed before the dies are set. Then, when the thread has been cut to this length, the plunger trips the pawl, causing the dies to open so as to free the pipe without the necessity of backing off the dies. A convenient means is provided for adjusting the dies to cut special threads.

As an indication of the quickness with which the dies can be set, it is mentioned that one piece each of 1-, 1 1/4-, 1 1/2- and 2-inch pipe may be easily threaded, chamfered, reamed, and cut off in less than seven minutes floor-to-floor time.



Red-E-Quick Self-opening and Quick-setting Die-head for Pipe from 1/2 to 2 Inches



Die Set Having Drop-forged Die-shoe and Punch-holder

Baumbach Drop-Forged Steel Die Sets

Die sets made of drop-forged steel are being placed on the market by the E. A. Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill. The die-shoes and punch-holders of these sets are drop-forged from 0.35 to 0.40 per cent carbon steel that has been completely normalized. All the shanks are drop-forged as an integral part of the punch-holder. The working surfaces are machined and ground.

Another feature of these die sets is that the punch-holders are fitted with bushings made of a steel having a high manganese content. These bushings are carburized, hardened, ground, and finally lapped to individual fits on the hardened and ground leader pins of the corresponding die-shoe. The claim made for this construction is that the leader pins and bushings maintain accurate alignment.

Other advantages mentioned for the drop-forged steel die sets include high tensile strength and durability, freedom from defects, unbreakable shanks, and die-shoes and punch-holders that will not crack or break. A complete stock of these die sets is kept on hand.

Westinghouse Gasoline-Driven Welders

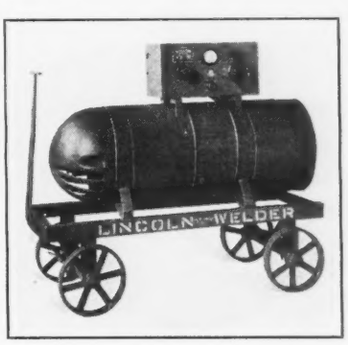
FlexArc gasoline-engine driven welders of 300 and 400 ampere ratings have been placed on the market by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These welders are provided with a full canopy protection from the weather and have accessible controls. There is provision against current surges and electrode sticking. Overside exciters can be supplied for operating small portable tools.

Lincoln Shield-Arc Welder

Portable Shield-Arc welders of the model illustrated are now built by the Lincoln Electric Co., Cleveland, Ohio, in alternating- and direct-current motor-driven types of 300, 400, and 600 ampere sizes. By simply removing the running gear and draw bar, the welders can be converted into stationary models. The principal feature claimed for these welders is a uniform welding current which allows the use of a higher average current for a given size of rod. This permits a considerable increase in the speed of welding and in the amount of weld metal deposited.

The new welders are rated at 40 volts instead of at 25 volts—the rating of the previous models—and thus they have a 60 per cent greater kilowatt rating than before. Current at 40 volts is desirable for use with the shielded-arc electrodes recently developed by the company.

The welders are of a design that makes a stabilizer or kick transformer unnecessary. A dual control permits independent regulation of the current and voltage. A reversible voltage control

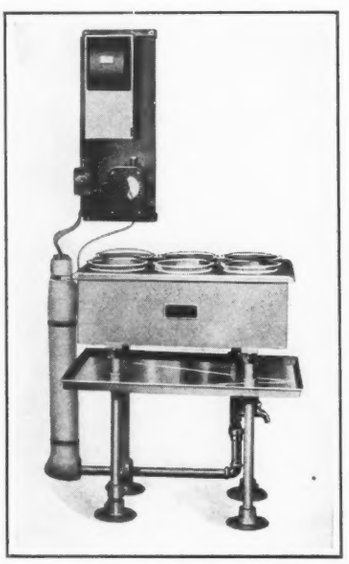


Shield-Arc Welder which is Available in Ratings of 300, 400, and 600 Amperes

is provided which reverses the direction in which the current is generated. This eliminates the shifting of cable connections in order to change the polarity of the welding current. A volt ammeter on the control panel, in addition to giving a reading of voltage and amperage, indicates whether the machine is operating with positive or negative polarity.

Thermostatically Controlled Electric Glue-Heater

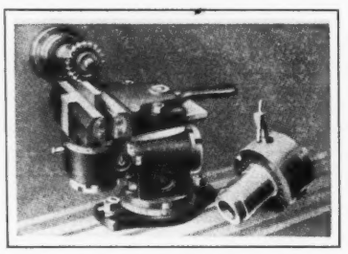
The temperature of the glue in a thermostatically controlled electric glue-heater being introduced to the polishing industry by the Divine Bros. Co., 101 Whitesboro St., Utica, N. Y., is maintained within 2 degrees F. of the desired temperature. After the glue in the pot has reached a temperature of 135 degrees F., the electric current is automatically cut off and remains off until the temperature of the bath has dropped two degrees, which usually occurs during an interval of from eight to ten minutes. The current is then again turned on for about two minutes to bring the bath back to the normal temperature, when it is once more shut off. This heater is made with four, six or eight pots, and the pots are available in five sizes, ranging in capacity from 2 to 8 quarts.



Electric Glue-Heater with Thermostat Control

Universal Clamping and Dividing Head

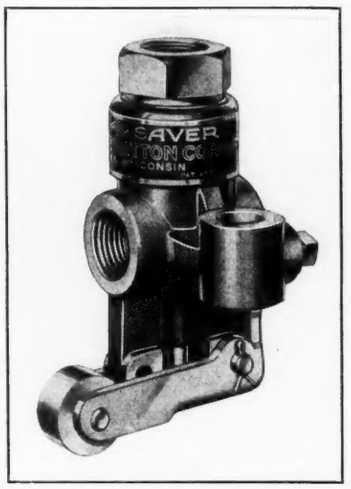
A universal clamping and dividing head intended for toolroom work, such as milling, drilling, planing, and grinding, when compound angles are involved, is being introduced to the trade by the International Engineering Service, Box 1340, Detroit, Mich. This appliance is particularly useful in the manufacture of cutters, spur and bevel gears, gages, clutches, etc. When used in connection with a tailstock, the head facilitates fluting operations on reamers, counterbores, and similar tools.



"Trigonom" Clamping and Dividing Head which can be Positioned at Any Angle

This appliance has been given the trade name of "Trigonom." It has a horizontal bearing which swivels on a baseplate that is graduated in degrees. This bearing can be adjusted to any angle in the horizontal plane by means of two screws. A swiveling cross-head that is also graduated in degrees and has a bearing that is adjustable from the vertical to any desired angle, rotates in the horizontal bearing. Both bearings can be locked securely after they have been placed in the correct position.

Different attachments can be inserted in the vertical bearing. There is an indexing arrangement that is completely protected. The height of this clamping and dividing head is approximately 8 inches.



Valve which Automatically Provides Intermittent Blasts of Compressed Air

Leakproof Air Valve

A leakproof air valve that provides an automatic intermittent control of compressed-air blasts for ejecting work, keeping dies and tools clean, and similar service, has been brought out by the Briggs & Stratton Corporation, Milwaukee, Wis. This "Air Saver" is intended for use on punch presses and other machine tools where drilling, boring, reaming, and similar operations require controlled blasts of air.

The valve is constructed to resist both wear and corrosion. The valve, valve seat, and valve spring are made of stainless steel and the air inlet bushing of brass. There is a long valve guide which is lined with a special graphited bronze bushing. Hardened steel is used for the reversible arm, roller, and bearing pins that operate the valve. The valve is made in one size only, with a 1/2-inch pipe inlet and an outlet up to 1/2 inch.

Speedway Midget Drill

A midget portable electric drill which is claimed to have unusual power for a drill of its size has been placed on the market by the Speedway Mfg. Co., 1834 S. 52nd Ave., Cicero, Ill. The machine weighs 3 pounds, is 9 inches long,

and has a capacity for drilling holes up to 3/16 inch in iron or steel.

This drill embodies a triple gear reduction and is driven by a motor that operates on both alternating and direct current. The non-load speed on the standard model is 1050 revolutions per minute, and the average load speed, 750 revolutions per minute. However, the spindle speed can be varied from 550 to 3000 revolutions per minute to meet requirements.

Oxweld Extensometer

The elongation caused in a standard test specimen by the heat of the human hand is indicated by a testing device known as the Extensometer, which has been developed by the Linde Air Products Co., 30 E. 42nd St., New York City.

This instrument was brought out for the purpose of determining the yield point of specimens being tested in an Oxweld portable tensile testing machine. It can also be used as a strain gage to determine the elongation of a specimen under a specific load.

Screw, Nut, and Stud Setters

Screw, nut, and stud setters, in suspended and pedestal models, are manufactured by the Foster Machine Co., Elkhart, Ind. These "Rightway" drivers, as they are called, are equipped with either a flexible shaft or a telescoping sleeve. The flexible shaft types are especially desirable when the nuts, screws, or studs to be set are widely spaced, while the telescoping sleeve type is particularly suitable for operations in which the equipment is suspended directly above the work. The telescoping sleeve has 6 inches of travel.

"Rightway" Screw, Nut, and Stud Setter of the Suspended, Flexible-shaft Type

The operator simply lowers and raises the sleeve in an operation.

The pedestal model is designed to provide portability. All these drivers can be operated on 220- or 440-volt alternating polyphase current, which permits of plugging into the regular power line.

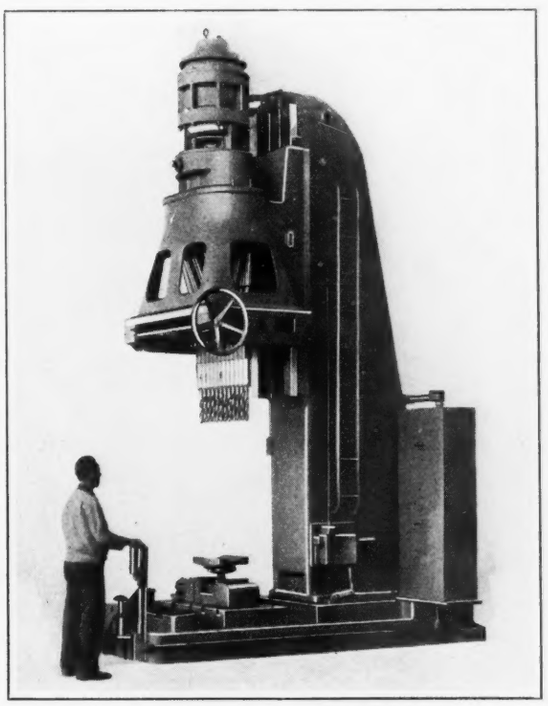
Natco Vertical Hydraulic Drilling Machine

A vertical hydraulic drilling machine designed especially for drilling the tube holes in large express-type boiler drums was recently built by the National Automatic Tool Co., Richmond, Ind. This machine is an adaptation of a standard model. It is equipped with a semi-automatic Oilgear hydraulic feed which is arranged with the patented Natco safety foot control and emergency reverse. The machine has a capacity for drilling twelve 1 1/2-inch holes in steel at a heavy feed. It is approximately 16 feet high.

The head of this machine is equipped with twelve upper-joint assemblies, each of which has a single speed and a neutral position. The head is furnished with roller bearings throughout. The spindle equipment consists of an adjustable bearing plate arranged to receive twelve spindles having Morse No. 4 taper sockets and nose adjustments. The spindles are held in a straight line parallel to the ways of the column. They have a horizontal adjustment toward and away from the column of 14 inches, the minimum and maximum distances being 22 and 36 inches, respectively.

The base is provided with two slots running from left to right which are of the proper depth to insert 75-pound rails. These slots are spaced to give a 36-inch center-to-center distance between the rails. There is a coolant reservoir within the base at the rear. Coolant is supplied to the work by an independent motor-driven pump. A shut-off valve is automatically turned on with each downward movement of the head.

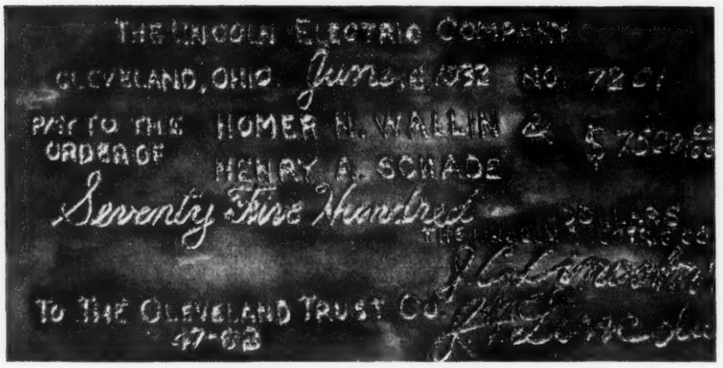
Between the two slots in the base there is an air-operated jack which is used to support the boiler drums while they are being drilled. The approximate weight of the machine is 38,000 pounds.



Natco Hydraulically Operated Drilling Machine Designed Especially for Handling Boiler Drums

Winners of Lincoln Arc-Welding Prizes

The Lincoln Electric Co., Cleveland, Ohio, has announced the winners in the Second Lincoln Arc-welding Prize Competition. The first prize—$7500—was won by Lieutenant Commander Homer N. Wallin and Lieutenant Henry A. Schade of the U. S. Navy. The second prize—$3500—was won by Major G. M. Barnes of the Ordnance Department of the U. S. Army. The third prize—$1500—was won by H. H. Tracy, structural engineer with the Southern California Edison Co., Los Angeles, Calif. In addition, thirty-eight other prizes ranging from $100 to $750 were awarded to engineers from many parts of the United States and from Germany, England, France, Austria, Belgium, and Australia. About 400 papers were submitted.



The Check for the First Prize in the Lincoln Arc-welding Contest was "Written" on 1/8-inch Sheet Steel, 10 by 24 Inches, by Means of the Arc-welding Process

The first three prize winners received what are believed to be the most unusual checks ever issued. These checks were "written" on 1/8-inch sheet steel by arc welding and were signed by the same process.

The Two Winners of the $7500 First Prize in the Second Lincoln Arc-welding Prize Competition, Lieutenant Commander Homer N. Wallin and Lieutenant Henry A. Schade of the U. S. Navy.

The Design and Construction of the Completely Arc-welded Vessel Shown in the Illustration was Described in Their Prize-winning Paper which Was One of 400 Entered in the Contest

MEN IN THE INDUSTRY

WILLIAM H. BASSETT, metallurgical manager of the American Brass Co., Waterbury, Conn., has been elected vice-president of the American Society for Testing Materials. Mr. Bassett is a graduate of the Massachusetts Institute of Technology, class of 1891. He became chief chemist and metallurgist of the American Brass Co. in 1913, and has since held the positions of technical superintendent and metallurgical manager. He is a past president of the American Institute of Mining and Metallurgical Engineers.

AMBROSE SWASEY, one of the founders of the Warner & Swasey Co., Cleveland, Ohio, and a past president of the American Society of Mechanical Engineers, was awarded the Franklin Medal and a certificate of honorary membership by the Franklin Institute, Philadelphia, Pa., at the Medal Meeting, May 18. Mr. Swasey, who was honored as the inventor of a range-finding device which proved of great service during the World War, delivered an address on "Astronomers and Their Telescopes."

R. E. LANKFORD has been appointed works manager of the J. A. Fay & Egan Co., Cincinnati, Ohio, manufacturer of woodworking machinery. Mr. Lankford has had a wide experience in plant management and engineering, having designed and patented many machines and tools in diversified lines of industry. He will have complete supervision of the design, engineering, and manufacturing of the woodworking equipment built by the company.

FRANK A. SPENCER has been appointed district manager of the Detroit territory for the National Acme Co., Cleveland, Ohio, manufacturer of Gridley and Acme automatic screw machines and screw machine products. Mr. Spencer has had many years' experience with the company's various lines, having formerly been connected with the Cleveland office. He is now located at 2826 E. Grand Blvd., Detroit, Mich.

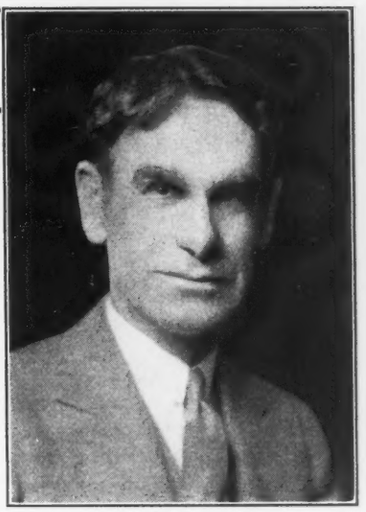
J. S. TRITLE has been elected vice-president in charge of operations of the Westinghouse Electric Supply Co., East Pittsburgh, Pa., wholesale distributor of Westinghouse products to electrical dealers, contractors, and industrial establishments. In addition to filling his new duties, Mr. Tritle will continue to serve as vice-president and general manager of the Westinghouse Electric & Mfg. Co.

ARTHUR JACKSON, president of the Arthur Jackson Machine Tool Co. of Toronto and Montreal, Canada, expects to sail for Europe July 15 on the *S.S. Ausonia*, accompanied by Mrs. Jackson. Mr. Jackson intends to visit the machine tool centers of Great Britain, Germany, France, Czechoslovakia, and Switzerland for the purpose of studying the latest machine tool developments in those countries.

CLOYD M. CHAPMAN, consulting engineer, New York City, has been elected president of the American Society for Testing Materials. Mr. Chapman is a graduate of Cornell University, class of 1898. For many years he was with Westinghouse, Church, Kerr & Co., and since 1920 he has been retained as consulting engineer by several corporations.

WALTER A. BLACK, formerly chief engineer of the Indianapolis Works of Fairbanks, Morse & Co., has been appointed district manager of the Cleveland office of the Allen-Bradley Co. at 942 Prospect Ave. John B. Vogel has been appointed district representative in charge of the office at 41 Grandville Ave., S. W., Grand Rapids, Mich.

ALVAN MACAULEY, president of the Packard Motor Car Co., was re-elected president of the National Automobile Chamber of Commerce at the annual meeting of the Chamber in New York, June 9. Mr. Macauley has been president of the Automobile Chamber for the last three years.



E. W. Miller, New President of the American Gear Manufacturers' Association

E. W. MILLER, chief engineer of the Fellows Gear Shaper Co., Springfield, Vt., was elected president of the American Gear Manufacturers' Association at its sixteenth annual meeting, recently held in Cleveland. Mr. Miller was born in Torrington, Conn., and after completing his schooling, became connected with the Fellows Gear Shaper Co. He first served a shop apprenticeship and then worked in the drafting department. In 1915 he was made chief engineer of the company. Mr. Miller has taken an active part in the work of the American Gear Manufacturers' Association for years, and has served on many important committees.

DR. CHARLES LEGEYT FORTESCUE, consulting transmission engineer for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., received the Elliott Cresson gold medal from the Franklin Institute, Philadelphia, May 18, for his outstanding achievements in electrical engineering.

B. F. WATERMAN of the Brown & Sharpe Mfg. Co., Providence, R. I., who for the last two years has served as president of the American Gear Manufacturers' Association, was made honorary president of the Association for life, at the last annual meeting in Cleveland.

An Abrasive Testing Sieve Shaker

A new machine to be used in connection with sieves for abrasives has been brought out by the Newark Wire Cloth Co., Newark, N. J., and is known as the "End-Shak" testing sieve shaker. The aim of the designers has been to devise a shaker that would put material through a testing sieve in a shorter time than is required with the usual equipment.

It is stated that the following objectives have been obtained: The sample is spread uniformly over the entire surface of the sieve; by a combination of reciprocating and slowly rotating movements the entire sieve surface is constantly utilized; jumping or bouncing of the sample particles is eliminated; and the machine is characterized by smooth operation. It is designed for 8-inch diameter testing sieves, and is adjustable to hold any number of sieves up to and including thirteen.

The machine may be arranged for either belt or motor drive, a 1/4-horsepower motor being used in the latter case. The period of the test is controlled by an automatic time switch. The weight of the device, including the motor and time switch, is 275 pounds.

NEWS OF THE INDUSTRY

REED-PRENTICE CORPORATION, Worcester, Mass., announces the following changes in its sales organization: G. W. McIntyre has been appointed eastern sales manager, with headquarters at 41 Broad St., New York City. D. C. Forsman has been appointed western sales manager and will be located at 8242 Woodward Ave., Detroit, Mich. The Triplex Machine Tool Corporation, 50 Church St., New York City, has been appointed exclusive agent for the Reed-Prentice line of lathes, milling machines, and complete line of machine tools in the New York and Connecticut territory. The Wolverine Machinery & Supply Co., 8242 Woodward Ave., Detroit, Mich., has been appointed exclusive agent for the Michigan territory, covering the full line of Reed-Prentice machine tools.

ADVANCE PRESSURE CASTINGS, INC., 34 North 15th St., Brooklyn, N. Y., has recently been formed, with A. F. Waltz as president. Mr. Waltz was president and general manager of the former Allied Die Casting Corporation. The organization includes also W. Jensen, Alfred Rusch, R. Zaleski, F. Dertinger, and H. Bonzak, all formerly connected in important capacities with the Allied Die Casting Corporation and all having die-casting experience over a period of years with several die-casting companies. The new company is equipped to handle die-casting production in zinc and aluminum alloys.

ELLIOTT SERVICE CO., INC., 242 W. 55th St., New York City, has opened a branch office at 729 Seward St., Detroit, Mich. A. M. Bennett will be in charge of the new office. The Elliott organization is engaged in supplying services for the promotion of accident prevention, waste elimination, and foremanship development in the industrial field. It is also a producer and distributor of news-picture advertising display services for banks and retail establishments.

STEPHENS-ADAMSON MFG. CO. OF CANADA, LIMITED, conveyor manufacturers at Belleville, Ontario, have concluded an arrangement with the Orton Crane & Shovel Co., Huntington, Ind., for the manufacture and exclusive sale in Canada of Orton locomotive cranes, dipper shovels, pull-back ditchers, skimmers, traveling gantry and cantilever cranes, and similar equipment. This equipment will be known as the "Saco-Orton" line.

DRIVER-HARRIS CO., Harrison, N. J., manufacturer of special alloys, has been licensed by the International Nickel Co., New York City, to melt and fabricate the corrosion-resisting alloy "Ni-Resist." As this alloy is resistant to moderately high temperatures, it is supplementary to "Nichrome" and other high-temperature alloys made by the Driver-Harris Co.

ELLIOTT MFG. CO., 215 Washington St., Binghamton, N. Y., has recently been formed by W. W. Elliott to manufacture flexible shafting and portable flexible-shaft grinders, die-sinkers, etc. Mr. Elliott has had many years of experience in the manufacture of this class of machinery, and was recently associated with the Binghamton Flexible Shaft Co.

ALLSTEEL PRESS CO., 12015 S. Peoria St., Chicago, Ill., manufacturer of the Verson all-steel line of punch presses, has established a commercial welding department to handle jobbing work. Broken press frames, beds, rams, and gears can readily be replaced with welded steel plate units at low cost, as no patterns or castings are necessary.

GEAR PROCESSING, INC., announces that the company, owing to increased business has removed from 79 Bethune St., W., Detroit, Mich., to a larger factory at 6700 Grant Ave., Cleveland, Ohio, which has been equipped with up-to-date toolmaking and production machinery, and a modern metallurgical laboratory.

KINGSBURY MACHINE TOOL CORPORATION, Keene, N. H., has recently made arrangements to have Stedfast & Roulston Inc., of Boston, Mass., represent the company in the exclusive sale of Kingsbury production drilling and tapping equipment throughout New England, with the exception of Connecticut.

WESTERN SCREW PRODUCTS CO., Main and St. George Sts., St. Louis, Mo., has been acquired by the MID-WEST SCREW PRODUCTS CO., a Missouri corporation incorporated in May. A number of plant changes will be made, but they will not interfere with the early resumption of operation.

POOLE FOUNDRY & MACHINE CO., Baltimore, Md., announce the appointment of the Ladd Equipment Co., First National Bank Bldg., Pittsburgh, Pa., as sales representative for the Poole all-metal flexible coupling in the Pittsburgh, Mahoning Valley, and West Virginia district.

GLENN D. ANGLE AND ASSOCIATES is a new organization formed to render consulting service in all branches of aeronautical and automotive engineering. The company is located at Parkway and Jackson St., Cincinnati, Ohio.

DARDELET THREADLOCK CORPORATION, 120 Broadway, New York City, has licensed the Pawtucket Mfg. Co. of Pawtucket, R. I., to manufacture and sell bolts and nuts with the Dardelet self-locking thread.

AMERICAN CABLE CO., New York City, announces that the Wickwire Spencer Steel Corporation has been licensed to manufacture preformed wire rope under the patents of the American Cable Co.

INLAND STEEL CO., First National Bank Bldg., Chicago, Ill., has opened offices at 1118-19 Fisher Bldg., Detroit, Mich. J. H. Fitch, Jr., is district sales manager of the new office.

KRON CO., manufacturer of dial scales, Bridgeport, Conn., has appointed Stoddard & Lively, 700 Bergen St., Newark, N. J., distributor of Kron scales in that territory.

Coming Events

OCTOBER 3-7—National Metal Congress, Buffalo, N. Y., sponsored by the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio, with the cooperation of the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Welding Society, and the Wire Association.

OCTOBER 3-8—Fourteenth annual National Metal Exposition to be held in the 174th Regiment Armory, Buffalo, N. Y. W. H. Eisenman, secretary, American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio.

New Publications

AMERICAN STANDARD SAFETY CODE FOR THE PROTECTION OF INDUSTRIAL WORKERS IN FOUNDRIES. 24 pages, 5¼ by 7½ inches. Published by the American Standards Association, 29 W. 39th St., New York City. Price, 20 cents.

THE MANUFACTURING EXPENSE BUDGET. 24 pages, 8 by 10½ inches. Published by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co., 1 Madison Ave., New York City.

This pamphlet is based on the budgetary practices of a number of manufacturing organizations. The several types of budgets used for the control of manufacturing expense are described and illustrated and the complete procedures of four companies are outlined in detail.

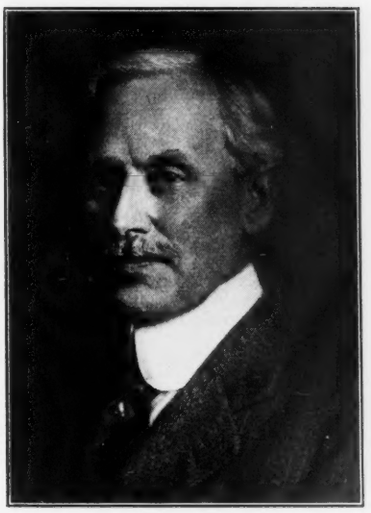
Obituaries

Luther D. Burlingame

Luther D. Burlingame, industrial superintendent of the Brown & Sharpe Mfg. Co., died Thursday, June 2, at his home in Providence, R. I., of pneumonia, after an illness of ten days. He was sixty-seven years old.

Mr. Burlingame was born at Whitestown (now Whitesboro), N. Y., in 1865. After having graduated from the Providence High School in 1884 as valedictorian, he entered the employ of the Brown & Sharpe Mfg. Co. as an apprentice in the drafting department, serving his apprenticeship both in that department and in the machine shop. He was made chief draftsman in 1888, when he was only twenty-three years old. At that time, there were fourteen employes in the drafting department. He continued as chief draftsman for more than twenty-five years, seeing the department grow to include more than 100 employes.

In 1914, he became industrial superintendent, chairman of the safety committee, and specialist in the patent work of the company. For many years he represented the company in various engineering societies, especially in the work of the American Society of Mechanical Engineers. He was an organizer of the Providence Engineering Society, and was for many years its president.



Luther D. Burlingame

He was also a member of the National Screw Thread Commission, of the Executive Committee of the American Institute of Weights and Measures, and of the board of directors of the National Safety Council.

He was for many years a director of the Providence Chamber of Commerce, president of the Providence Safety Council, and president of the Civic Improvement and Park Association of Rhode Island. Recently, he was made chairman of the Committee on Subsistence Gardens of the Governor's Conference on Employment and Relief.

Mr. Burlingame was well known in the mechanical engineering field and leaves an unusually large number of friends throughout the industry. His personality and character were of the kind that not only commanded high regard and respect, but also inspired lasting friendship and affection.

Mr. Burlingame is survived by his widow, two sons, and two daughters.

GEORGE W. PAGE, vice-president and a director of the W. A. Jones Foundry & Machine Co., Chicago, Ill., died on May 29. Mr. Page had been with the company for thirty-three years, beginning his career as a shipping clerk in 1899. He was fifty-one years old.

A Heat-Proof Element that is Added to Lubricants

An oil product embodying a heat-proof graphitic element has been brought out by the Pyroil Co., LaCrosse, Wis. It is intended that this product be added in small quantity to regular lubricants, the claim being made that the heat-proof element deposits itself on bearings and frictional surfaces, creating a slippery glossy film that is capable of lubrication in cases of loss or deterioration of the regular lubricant.

Exposition of Power and Mechanical Engineering

The tenth National Exposition of Power and Mechanical Engineering will be held December 5 to 10 at the Grand Central Palace, New York City, coincident with the annual meeting of the American Society of Mechanical Engineers. Up to the present time nearly 300 manufacturers of power-producing equipment, mechanical devices for power transmission, and material-handling equipment have reserved space.

Societies, Schools and Colleges

MICHIGAN COLLEGE OF MINING AND TECHNOLOGY, Houghton, Mich. Bulletin containing announcement of courses for the year 1932-1933 and general information concerning the college.

CLARKSON COLLEGE OF TECHNOLOGY, Potsdam, N. Y. Annual catalogue containing calendar for 1932-1933 and courses of study.

Do You Know

that savings amounting to as much as 30 per cent of former costs are being made by the use of arc-welded construction for jigs and fixtures?—see page 811.

what constituents in lubricating oil will practically double its load-carrying capacity in bearings?—see page 817.

what new methods have been developed for boring very accurate holes in cast iron, bronze, aluminum, and non-metallic materials?—see page 823.

what are considered the best speeds and feeds to use in present machine shop practice for carbon and high-speed steel drills?—see page 816.

what are the generally used standard tapers and threads on drill chuck shanks?—see page 840A.

what advantages are claimed for having assemblers of small products seated at right angles to the passing conveyors?—see page 844.

how to use charts in making rapid cost estimates and in rate-setting?—see page 815.

Classified Contents of this Number

Design, Fixture and Tool

High Production with Pneumatic Fixtures..... 832
Jig for Drilling Radial Hole in Bushing—*By Charles C. Tomney*..... 837
Collet for Over- or Under-size Cutter Shanks—*By F. A. Firnhaber*..... 838
Air-operated Chuck that Centralizes Work at Both Ends 840
The Labor Cost is not the Whole Cost..... 845
Taper Adapter for Milling Cutters—*By R. A. Dressler*..... 847

Design, Machine

Automatic Indexing Head with Self-locking Mechanism—*By Otto R. Winter*..... 819
Ejecting Device for Inclined Power Press—*By Edward Lay*..... 820
Overload Relief Mechanism—*By H. F. Server*.... 821
Shock-absorbing Flexible Coupling—*By W. E. Stewart*..... 836
Short Method of Triangle Calculation—*By George W. Amrhein*..... 843
Hand-operated Hopper for Assembling Balls..... 847

Diemaking, Die Design, and Press Work

Indenting in a Power Press by the Spot-welding Method—*By Avery E. Granville*..... 830
Die for Cutting Down All the Blades in a Fan Simultaneously—*By Eugene L. Soltner*..... 835
Self-adjusting Guides for Strip Stock..... 837
Bulging Die for Crowning Pressed-steel Pulley—*By George L. Pyritz*..... 839
Feeding Stock from Bottom of Coil Corrects Trouble—*By Eugene L. Soltner*..... 846
Rolling Down Burrs in a Power Press—*By J. E. Fenno*..... 849

Drafting-Room Practice

Obsolete Traditions in the Drafting-room—*By John F. Hardecker*..... 822
Made-to-Order Draftsmen's Curves—*By A. W. Eidman*..... 846

Heat-Treating Methods

Present Practice in Nitriding Steel—*By H. A. Pearson*..... 809
Apparatus for Hardening Delicate Work—*By Hubert R. Schmidt*..... 842

Inspection and Gaging Methods

Adjustable Limit Gage for Production Work—*By H. S. Taylor*..... 836

Management Problems

Metal-working Machinery Exports in 1931..... 808
Charts for Rate Setting and Cost Estimating—*By H. H. Herzog*..... 815
A Courageous Texas Farmer Sets a Good Example 818
There Has Been No Depression in the Realm of Ideas 818
A Leading Industry Decides to Accept a New Responsibility 818
Volume-mindedness is a Long Word Well Worth Thinking About 818
Eliminating Employes' Mistakes—*By Charles R. Whitehouse*..... 822
Freedom in Selecting Methods—*By A. I. Cook*.... 822
Tool and Die Makers Take Contracts from Their Own Firm—*By B. C. Booth*..... 826
Second-hand Machinery—*By Leo T. Parker*..... 848

Materials, Metals, and Alloys

The Designer Has a Wide Choice of Materials—*By James Vincent*..... 831
Experiments with Alloy Cast Iron..... 843
Stainless Steel Tubing..... 845
Chromium-plating for Wear—*By W. S. Brown*.... 848
A Rubber Substitute that is not Affected by Gases and Liquids 854

Meetings and Conventions

Spring Meeting of Associated Machine Tool Dealers 810
Meeting of Automotive Engineers at White Sulphur Springs 821
June Meeting of Tool Engineers..... 847
The National Metal Congress in Buffalo..... 850
Foremen Meet in National Convention..... 853
American Society of Mechanical Engineers Meets in Canada 854

Railway Shop Practice

"Penetrating" Oil for Removing Tight Nuts and Studs—*By Edwin G. Jones*..... 833
Modern Equipment in a Railroad Babbitting Shop 834

Shop Practice, General

Modern Automobile Transmissions Require New Standards of Accuracy—*By Charles O. Herb*.... 801
Speeds and Feeds for Carbon and High-speed Steel Drills—*By A. J. Snyder*..... 816
Precision Boring with Diamond and Cemented-carbide Tools 823
Economical Milling Procedure Developed by Engineering Study 827
Separator for Filtering Compressed Air—*By F. C. Mason*..... 830
How to Avoid Overstraining Screws..... 832
Cutting off Bar Stock at the Rate of One Piece per Second—*By H. C. Meyers*..... 841
Advantages Obtained by Seating Assemblers at Right Angles to Conveyor..... 844
Attaching Auxiliary Devices to Machines Having Rough Surfaces—*By Henry W. Boehly*..... 846
"Warming Up" Drills and Broaches to Prevent Breakage—*By Charles R. Whitehouse*..... 847
Getting Best Results from Belted Motor Drives—*By Robert W. Drake*..... 851
New Shop Equipment..... 857

Welding Practice

Arc-welded Jigs, Fixtures, and Gages—*By L. E. Fuller*..... 811